Energy, Mines and Resources Canada | Énergie, Mines et Ressources Canada

CANMET

Canada Centre for Mineral and Energy Technology | Centre canadien de la technologie des minéraux et de l'énergie

PROCESSING AND EVALUATION OF ROUND ROBIN ANALYTICAL RESULTS FOR THE CERTIFICATION OF BLAST FURNACE SLAG SL-1 AS A REFERENCE MATERIAL

W.S. Bowman and R. Sutarno

Physical Sciences Laboratory
Physical Chemistry Section

May 1977

This document is an unedited interim report prepared primarily for circulation and discussion among technical colleagues. It does not represent final opinion of the Centre for Mineral and Energy Technology (CANMET)

Ce document est un rapport provisoire non-revisé et rédigé principalement pour fin de ... de documentation. Il ne représente aucunement une opinion définitive du Centre canadien de la technologie des minéraux et de l'énergie (CANMET)

MICROMEDIA

For Internal Use Only:

Project MRP-3.3.4.4.01
Reference Materials - CCRMP

DECLASSIFIED
DATE 5/5/83
AUTHORIZED BY

62 pp

MINERALS RESEARCH PROGRAM

Mineral Sciences Laboratories
Report MRP/MSL(CF)77-16(TR)

CONFIDENTIAL

Mineral Sciences Laboratories
Report MRP/MSL(CF)77-16(TR)

PROCESSING AND EVALUATION OF ROUND ROBIN ANALYTICAL RESULTS FOR THE CERTIFICATION OF BLAST FURNACE SLAG SL-1 AS A REFERENCE MATERIAL

by

W.S. Bowman and R. Sutarno

SYNOPSIS

SL-1 is a blast furnace slag which has been characterized and prepared for use as a certified reference material.

This report is a detailed account of the processing and evaluation of the analytical results obtained from the interlaboratory program undertaken to certify this material.

This report is intended to be an internal reference for CANMET personnel. It will serve as a basis for a CANMET report describing the material and as a detailed record of the various statistical procedures which were applied to it.

INTRODUCTION

The characterization and certification of the blast furnace slag SL-1 is a facet of the Ferrous Task Force of the Canadian Certified Reference Materials Project (CCRMP). The co-ordinator of this aspect of CCRMP activities is Mr. G.L. Mason, Mineral Sciences Laboratories.

Contributors to the interlaboratory certification program were each given two randomly-selected bottles of SL-1 and were asked to determine a number of constituents (mainly oxides) in each bottle, in triplicate using a method of their choice. Some provided results by more than one analytical method; in such cases, each set of results was considered to be independent of the others, i.e., each set was treated as though it came from a different laboratory.

PARTICIPATING LABORATORIES

The names of the contributing laboratories and the lab number assigned to them are listed below. The gaps in the list result from the fact that certain laboratories agreed to participate and then found that they could not meet the deadline.

LAB-2 Interlake Inc., Beverley, Ohio, U.S.A.

LAB-3 Amsted Research Laboratories, Bensenville, Illinois, U.S.A.

LAB-4 Inland Steel Company, East Chicago, Indiana, U.S.A.

LAB-5 British Steel Corporation, Swinden Laboratories, Rotherham, England.

LAB-6 Sydney Steel Corporation, Sydney, Nova Scotia.

LAB-7 United States Steel Corporation, Duquesne, Pennsylvania, U.S.A.

LAB-9 Hudson Bay Mining and Smelting Co., Ltd., Flin Flon, Manitoba.

LAB-10 Cominco Ltd., Trail, British Columbia

LAB-11 The Steel Company of Canada, Ltd., Hamilton, Ontario.

LAB-12 Mineral Sciences Laboratories, CANMET, Ottawa, Ontario.

LAB-13 British Steel Corporation, Research Centre, Teesside, England.

LAB-14 British Steel Coporation, Carbon Steels Works Group, Rotherham, England.

LAB-16 Mineral Research Branch, Ministry of Natural Resources, Toronto, Ontario.

LAB-17 Analytical Chemistry Section, Geological Survey of Canada, Ottawa, Ontario.

After a preliminary statistical analysis of the interlaboratory data, it was obvious that more results would be necessary in order to be able to certify this material for CaO and MgO. The following laboratories agreed to contribute data for these constituents and, in some cases, other components as well.

LAB-18 Bethlehem Steel Corporation, Homer Research Labs., Bethlehem, Pennsylvania.

LAB-20 Inco, Copper Cliff, Ontario.

LAB-21 Armco Steel Corporation, Middletown, Ohio, U.S.A.

LAB-22 The Algoma Steel Corporation Ltd., Sault Ste Marie, Ontario.

LAB-23 Falconbridge Nickel Mines Limited, Metallurgical Laboratories, Thornhill, Ontario.

LAB-24 Wheeling Pittsburgh Steel Corp., Stoubenville, Ohio, U.S.A.

LAB-25 U.S. Steel, Research Labs., Munroeville, Pennsylvania, U.S.A.

DATA PROCESSING

All data processed for the CCRMP is done by means of a Dept. of EMR - CDC computer system feature called UPDATE[1,2]. This feature uses card images on either disk or tape. Development

of the data set and production runs are done on disk files, while the final copy, which is retained indefinitely, resides in the EMR tape library. The following information is required to access the tape for SL-1.

VSN = E11571

L = SL1

D = PE (9-track)

UPDATE provides a sequence number for each card image for SL-1. These are grouped by constituent/element into decks. There are 14 decks in all: SIO2, CAO, MGO, AL203, TIO2, FEO*, MNO, S, P205, V205, NA20, K20, CR203, FERROUS**. A hard copy of the results plus card identifiers (sequence numbers) is kept by the authors***. A new copy can be generated, if necessary, from the tape file. The UPDATE file can be modified either temporarily or permanently by using DELETE, INSERT and other control cards. The history of all modifications is retained on the file, and it is a simple matter to revert to some pre-modification stage. For example, certain "gross" outliers were deleted from the original file for SL-1 and the master tape reflects this. However, should it be required, these values could be reinstated - i.e. the information is not lost. The correction IDENT for the insertion of the "second round" results is MOD2.

---

*FEO consists of total iron expressed as FeO.
**Ferrous consists of ferrous iron only expressed as FeO.
***Copies may be obtained from the authors.

DETECTION OF OUTLIERS

All of the data reported by the participating laboratories is listed in Tables 1a to 1n and is presented graphically in Figures 1a to 1n. It is standard practice in CCRMP certification schemes to consider sets of results whose means differ from the overall mean by more than twice the overall standard deviation as outlying values. These "outliers" are not included in the estimation of the consensus value and confidence limits for a particular constituent in order to avoid the introduction of bias. However, from an examination of Figures 1a to 1n, it was obvious that for SL-1 there were certain "gross" outliers that caused the overall standard deviation to be unreasonably large. Thus it was arbitrarily decided to reject such gross outliers before proceeding further. The correction IDENT for this deletion is MOD1. A list of the sets rejected by MOD1 along with the UPDATE directives follows:

```
*IDENT MOD1 (gross outliers)
*DELETE        SIO2.14, SIO2.17                (Lab-3 (a.a.))
*DELETE        CA0.50, CAO.57                  (Lab-9 (a.a.))
*DELETE        AL203.34, AL203.41              (Lab-6)
*DELETE        TIO2.18, TIO2.25                (Lab-4 (a.a.))
*DELETE        TIO2.34, TIO2.41                (Lab-6)
*DELETE        S.123, S.128                    (Lab-17 (xrf))
*DELETE        V205.18, V205.21                (Lab-7)
```

*DELETE	NA20.84, NA20.89	(Lab-17 (xrf))
*DELETE	CR203.62, CR203.69	(Lab-16 (a.a.))

The sets deleted are circled with a solid line in Figures 1a to 1n and in Tables 1a to 1n they have a line drawn through them. Such gross outliers are assumed to be caused by some physical reason. Their rejection is considered permanent and it is not intended that they should appear in the CANMET report which will be distributed with certified bottles of SL-1.

On the other hand, "statistical" outliers (those whose means differ from the overall mean by more than twice the overall standard deviation) should appear in the tables and figures of the CANMET report although they are not used for estimation of the consensus values and confidence limits. The deletion of these results is temporary, and any correction IDENT may be used. A list of such sets along with the UPDATE directives follows:

*IDENT STAT (statistical outliers)

*DELETE	CAO.125, CAO.130	(Lab-17 (xrf))
*DELETE	MGO.128, MGO.133	(Lab-17 (xrf))
*DELETE	AL203.50, AL203.57	(Lab-9 (a.a.))
*DELETE	TIO2.110, TIO2.115	(Lab-17 (xrf))
*DELETE	FEO.14, FEO.17	(Lab-3 (a.a.))
*DELETE	FEO.48, FEO.63	(Lab-9 (vol.) & Lab-9 (a.a.))
*DELETE	MNO.4, MNO.13	(Lab-2)
*DELETE	MNO.122, MNO.127	(Lab-17 (xrf))
*DELETE	K20.38, K20.45	(Lab-9 (a.a.))
*DELETE	CR203.4, CR203.7	(Lab-3 (a.a.))

Sets which were found to be "statistical" outliers are circled with a dashed line in Figures 1a to 1n are marked with an asterisk in Tables 1a to 1n.

HOMOGENEITY ASSESSMENT

Tables 2(a) to 2(n) give the means, coefficients of variation and summary of the t-test between bottles at the 5% significance level for all sets of results for SL-1 except the gross outliers. The words "REJECT" or "***R***" means that, for that set of results, the means of the two bottles are statistically different. In addition, a two-way ANOVA with nested design[3] was performed on the data. A lot of data could not be used since the design requires equal replicate for each bottle for each set (three replicates were used). The ANOVA tables and the estimates of between-set, between-bottle, and within-bottle standard deviations (PSI, OMEGA, and SIGMA) are given in Tables 3(a) to 3(h) for the eight constituents for which there were sufficient data. Only in the cases of alumina and sulphur were the between-bottle differences insignificant at 95% probability. In other cases, the differences, although significant, are, in reality, very small when compared to the large between-set component of variance. SL-1 should be suitably homogeneous for most applications, but a user might be able to detect small bottle to bottle variations.

ESTIMATION OF CONSENSUS VALUES AND RELATED STATISTICAL PARAMETERS

A one-way ANOVA technique[3] was used to calculate the consensus values and to estimate the variance of the means and hence the 95% confidence limits. The mathematical model and general ANOVA table are given in each CANMET report for a particular material (e.g. SCH-1[4]).

All outliers were excluded from these computations. The consensus values and confidence limits and various other statistics are given in Table 4. For the cases where new results were obtained following the initial assessment, the original statistics are given in brackets.

Column 11 of Table 4 contains the certification factors for the various constituents of SL-1. The certification factor is a measure of the quality of a reference material that was conceived by the CCRMP[5]. It is the ratio of the confidence interval as a percentage of the mean (column 9) to the average coefficient of variation for all the sets (column 10). If the certification factor exceeds the critical value of 4, then it is recommended that the material be assigned a provisional value for that constituent. It should be noted that the closer the agreement within sets, the smaller the spread must be between sets (cf. FeO and MnO).

RECOMMENDATION

The certification factors for SiO_2, CaO, MgO, Al_2O_3, total iron as FeO, and sulphur are less than the critical value of 4 and their consensus values should be adopted as recommended values. The consensus values for TiO_2 and MnO should be assigned as provisional values. The means for Na_2O, K_2O, P_2O_5, Cr_2O_3 and ferrous iron as FeO should be given for information only. In the case of V_2O_5, it is intuitively felt that some of the high results are probably incorrect and that the median value (0.005) should be reported for that constituent.

	Recommended Value, %	95% Confidence Limits	
		Low, %	High, %
SiO_2	35.73	35.61	35.86
CaO	37.48	37.30	37.65
MgO	12.27	12.12	12.41
Al_2O_3	9.63	9.56	9.71
Total Iron as FeO	0.92	0.89	0.96
S	1.26	1.23	1.28

	Provisional Value, %
TiO_2	0.38
MnO	0.86

	For Information Only
Na_2O	0.39
K_2O	0.51
P_2O_5	0.019
V_2O_5	0.005
Cr_2O_3	0.009
Ferrous Iron as FeO	0.71

REFERENCES

1. Control Data Corporation Cyber 70 UPDATE Reference Manual, Control Data Corporation Publication No. 60342500.
2. BOWMAN, W.S., The use of UPDATE to process data files, Mineral Sciences Laboratories Report MRP/MSL 75-176 (TR).
3. BROWNLEE, K.A., Statistical Theory and Methodology in Sciences. John Wiley and Sons, Inc., New York (1961).
4. Members of the Staff of Mineral Sciences Laboratories, (Compiled by H.F. Steger, W.S. Bowman, R. Sutarno and G.H. Faye), Iron Ore, SCH-1: Its characterization and preparation for use as a certified reference material. Mineral Sciences Laboratories Report MRP/MSL 75-168 (TR).
5. SUTARNO, R., and FAYE, G.H., A measure for assessing certified reference ores and related materials, Talanta, 22, 676-681 (1975).

Table 1(a)

SiO_2 results for SL-1

	SILICA (WEIGHT PERCENT)										SAMPLE WT. G
LAB- 2	35.89	35.94	36.00	35.94	36.20	35.89	36.01	36.00			
~~LAB- 3 (A.A.)~~	~~34.60~~	~~34.71~~									
LAB- 4	35.80	35.68	35.98	35.80	35.76	35.78					
LAB- 5 (GRAV.)	35.92	35.49	36.02	35.90	35.88	35.90					
LAB- 6	35.12	35.24	35.18	35.56	35.56	35.57					
LAB- 7	35.85	36.04	35.89	36.03	35.99	36.00					
LAB- 9 (GRAV.)	35.76	35.68	35.68	35.66	35.66	35.72					
LAB-10 (GRAV.)	36.10	36.00	36.10	36.00	36.10	36.10					
LAB-11 (GRAV.)	35.60	35.60	35.70	35.60	35.70	35.70	35.80	35.80			
LAB-12 (GRAV.)	35.61	35.70	35.63	35.62	35.63	35.74					
LAB-13 (GRAV.)	35.92	35.88	35.86	35.88	35.90	35.86					
LAB-14 (GRAV.)	35.47	35.50	35.62	35.50	35.55	35.63					
LAB-16 (GRAV.)	35.45	35.53	35.55	35.55	35.58	35.53					
LAB-16 (A.A.)	35.50	35.80	35.50	35.50	35.50	35.30					
LAB-17 (XRF)	35.70	35.70	34.90	35.20							1
LAB-17 (GRAV.)	36.20	36.24									12
LAB-21 (XRF)	35.85	35.97	35.99	35.84	35.83	35.94	36.15	36.12	35.90	36.19	
LAB-21 (A.A.)	35.20	35.75	35.56	35.62							
LAB-21 (GRAV.)	35.30	35.24	35.48	35.30							

Note - Entries with a line through them are "gross" outliers.

Entries marked * are "statistical" outliers.

Table 1(b)

CaO results for SL-1

LIME (WEIGHT PERCENT)

										SAMPLE WT. G
LAB- 2	36.94	37.02	37.16	37.06	36.98	36.93	36.96	36.95		
LAB- 3 (A.A.)	38.20	38.06								
LAB- 4	38.50	38.50	38.50	38.50	38.00	38.50				
LAB- 5 (VOL.)	37.50	37.50	37.68	37.50	37.61	37.31				
LAB- 6	37.56	37.64	37.48	37.48	37.50	37.46				
LAB- 7	37.21	37.16	37.17	37.28	37.27	37.30				
~~LAB- 9 (A.A.)~~	~~34.70~~	~~34.70~~	~~34.70~~	~~34.70~~	~~35.10~~	~~34.70~~				
LAB-10 (VOL.)	37.40	37.40	37.30	37.40	37.40	37.30				
LAB-10 (A.A.)	37.60	37.60	37.10	37.60	37.60	37.60				
LAB-11 (COMPL.)	37.21	37.26	37.47	36.99	37.47	37.47	36.99	37.47	37.03	
LAB-11	37.14	37.10	37.10	37.12	37.08	37.10	37.10	37.14	37.14	37.12
LAB-12 (GRAV.)	37.49	37.91	37.65	37.70	37.72	37.69				
LAB-13 (VOL.)	37.80	37.80	37.90	37.70	37.80	37.80				
LAB-14 (VOL.)	38.30	38.30	38.30	38.30	38.20	38.20				
LAB-16 (GRAV.)	37.45	37.51	37.60	37.34	37.42	37.40				
LAB-16 (A.A.)	37.40	37.40	37.40	37.20	37.40	37.40				
* LAB-17 (XRF)	36.10	36.00	35.80	36.10						
LAB-17 (A.A.)	36.50	36.60								
LAB-18	36.73	37.00	36.72	36.94	36.87	36.83	36.95	37.02	36.89	37.06
	36.99	36.97								
LAB-20 (A.A.)	37.60	37.40	37.40	37.50	37.50	37.70	37.60	37.40	37.40	37.40
LAB-21 (XRF)	37.19	37.64	37.21	37.56	37.05	36.55	36.84	37.42	36.92	37.01
LAB-21 (GRAV.)	36.98	36.92	37.00	36.95						
LAB-22 (XRF)	37.61	37.48	37.55	37.62	37.78	37.87	37.77	37.96	37.88	37.62
LAB-22 (VOL.)	37.85	37.45	37.66	37.80	37.71	37.70	37.82	37.78	37.62	37.82
LAB-23 (VOL.)	37.67	37.68	37.60	37.58	37.66	37.48	37.57	37.53	37.59	37.58
LAB-24 (GRAV.)	38.24	38.20	37.68	38.00	38.56	37.84	37.62	37.56	38.14	38.14
LAB-25 (GRAV.)	37.41	37.41	37.40	37.38	37.32	37.40	37.37	37.44	37.44	37.34

Table 1(c)

MgO results for SL-1

MAGNESIA (WEIGHT PERCENT)

									SAMPLE WT. G	
LAB- 2	12.40	12.37	12.35	12.45	12.52	12.29	12.49	12.50		
LAB- 3 (A.A.)	12.20	12.26								
LAB- 4	11.88	11.88	11.88	11.88	11.88	11.88				
LAB- 5 (GRAV.)	11.78	12.15	11.95	12.00	12.02	12.00				
LAB- 6	11.78	11.93	12.09	11.58	11.64	11.66				
LAB- 7	11.84	11.85	11.90	11.91	11.86	11.88				
LAB- 9 (A.A.)	12.20	12.30	12.20	12.20	12.40	12.20				
LAB-10 (GRAV.)	12.60	12.60	12.60	12.60	12.70	12.60				
LAB-10 (A.A.)	12.40	12.40	12.40	12.40	12.40	12.40				
LAB-11 (COMPL.)	12.96	12.90	12.73	12.88	12.96	12.81	13.25	13.27	12.78	12.96
	12.88	12.81								
LAB-11	12.60	12.64	12.56	12.65	12.57	12.56	12.59	12.52	12.54	12.57
LAB-12 (GRAV.)	12.76	12.72	12.75	12.71	12.54	12.75				
LAB-13 (A.A.)	12.27	12.27	11.94	11.94	11.94	12.27				
LAB-14 (GRAV.)	12.38	12.38	12.43	12.46	12.43	12.40				
LAB-16 (GRAV.)	12.21	12.13	12.10	12.20	12.23	12.23				
LAB-16 (A.A.)	12.10	12.10	12.10	12.20	12.20	12.20				
* LAB-17 (XRF)	13.20	13.10	13.30	13.00						
LAB-17 (A.A.)	11.70	11.68								
LAB-18	11.81	12.20	11.88	12.09	12.00	11.98	11.74	12.02	11.80	12.16
	11.88	11.98								
LAB-20 (A.A.)	12.20	12.10	12.10	12.10	12.20	12.20	12.10	12.10	12.20	12.20
LAB-21 (XRF)	12.05	12.33	12.16	11.89	12.17	12.20	12.15	12.18	12.35	12.08
LAB-21 (A.A.)	12.35	12.19	12.19	12.27						
LAB-21 (GRAV.)	12.37	12.38	12.41	12.42						
LAB-22 (XRF)	11.75	11.77	11.55	11.86	11.57	12.09	12.13	12.02	12.28	11.96
LAB-22 (VOL.)	11.61	11.69	11.49	11.88	11.72	11.98	12.02	12.20	12.12	12.00
LAB-23 (VOL.)	12.60	12.57	12.57	12.63	12.69	12.63	12.52	12.52	12.53	12.51
LAB-24 (GRAV.)	13.06	12.62	12.46	12.96	13.30	13.01	12.52	12.50	13.22	13.01
LAB-25 (GRAV.)	11.97	12.25	12.12	12.12	12.14	12.06	12.07	11.92	11.98	12.10

Table 1(d)

Al_2O_3 results for SL-1

	ALUMINA (WEIGHT PERCENT)						SAMPLE WT. G				
LAB- 2	9.99	9.99	9.92	9.89	9.92	10.07	9.77	10.22			
LAB- 3 (A.A.)	9.47	9.34									
LAB- 4	9.70	9.70	8.96	9.40	9.84	9.40					
LAB- 5 (GRAV.)	9.60	9.48	9.51	9.49	9.63	9.53					
~~LAB- 6~~	~~11.02~~	~~10.68~~	~~11.00~~	~~11.24~~	~~11.14~~	~~11.20~~					
LAB- 7	9.67	9.64	9.65	9.64	9.65	9.68					
*LAB- 9 (A.A.)	9.00	8.90	9.00	9.00	9.20	9.00					
LAB-10 (GRAV.)	9.60	9.60	9.60	9.60	9.60	9.60					
LAB-10 (A.A.)	9.60	9.60	9.60	9.60	9.60	9.60					
LAB-11 (COMPL.)	9.77	9.79	9.83	9.77	9.79	9.77	9.77	9.83			
LAB-12 (GRAV.)	9.65	9.59	9.60	9.56	9.68	9.59					
LAB-13 (A.A.)	9.30	9.40	9.50	9.30	9.19	9.50					
LAB-14 (VOL.)	9.70	9.50	9.65	9.50	9.50	9.50					
LAB-16 (A.A.)	9.61	9.60	9.69	9.61	9.69	9.61					
LAB-17 (XRF)	9.61	10.10	9.64	9.25							
LAB-17 (A.A.)	9.52	9.52									
LAB-21 (XRF)	9.52	9.63	9.68	9.64	9.61	9.51	9.68	9.82	9.69	9.75	15
LAB-21 (GRAV.)	9.68	9.50	9.58	9.54							
LAB-22 (XRF)	9.66	9.72	9.74	9.67	9.59	9.69	9.62	9.62	9.74	9.84	

Table 1(e)

TiO_2 results for SL-1

TITANIA (WEIGHT PERCENT)

											SAMPLE WT. G
LAB- 2	.37	.38	.37	.37	.37	.37	.39	.36			
LAB- 3 (A.A.)	.42	.41									
~~LAB- 4 (A.A.)~~	~~.19~~	~~.19~~	~~.19~~	~~.19~~	~~.19~~	~~.19~~					
LAB- 5 (COLOR.)	.36	.37	.36	.36	.36	.36					
~~LAB- 6~~	~~.10~~	~~.11~~	~~.10~~	~~.13~~	~~.12~~	~~.13~~					
LAB- 7	.33	.33	.33	.33							
LAB-10 (COLOR.)	.36	.36	.36	.36	.36	.36					
LAB-11 (COLOR.)	.40	.40	.40	.42	.42	.42	.42	.42	.42	.42	
	.42	.42									
LAB-12 (COLOR.)	.41	.42	.40	.41	.41	.41					
LAB-13 (COLOR.)	.38	.37	.36	.38	.35	.37					
LAB-14 (COLOR.)	.37	.38	.37	.37	.37	.37					
LAB-16 (COLOR.)	.35	.36	.36	.36	.37	.36					
LAB-16 (A.A.)	.38	.38	.38	.38	.38	.38					
* LAB-17 (XRF)	.28	.27	.27	.27							
LAB-17 (A.A.)	.34	.33									
LAB-17 (SPECTR.1)	.37	.37	.37	.40	.42	.39					
LAB-17 (SPECTR.2)	.43	.42	.42	.42	.42	.40					
LAB-21 (XRF)	.37	.38	.37	.38	.37	.36	.37	.38	.37	.37	
LAB-21 (COLOR.)	.33	.33	.34	.32	.34	.34	.36	.32			

Table 1(f)

FeO results for SL-1

TOTAL IRON (WEIGHT PERCENT)

											SAMPLE WT. G
LAB- 2	1.150	1.080	1.150	1.070	1.100	1.090	1.080	1.070			
* LAB- 3 (A.A.)	1.240	1.250									
LAB- 4	.970	.970	.970	1.030	1.030	.970					
LAB- 5 (VOL.)	.939	.823	.901	.901	.862	.901					
LAB- 6	1.140	1.140	1.140	.920	.920	.910					
LAB- 7	.875	.875	.875	.875							
* LAB- 9 (VOL.)	1.286	1.158	1.286	1.158	1.286	1.286					
* LAB- 9 (A.A.)	1.222	1.222	1.248	1.274	1.235	1.248					
LAB-10 (A.A.)	.900	.900	.890	.890	.890	.900					
LAB-11 (COLOR.)	.890	.910	.890	.900	.900	.900	.900	.900	.900	.900	
	.910	.900									
LAB-12 (VOL.)	.880	.900	.880	.880	.880	.860					
LAB-12 (A.A.)	.890	.880	.880	.870	.860	.860					
LAB-13 (A.A.)	.913	.926	.939	.926	.952	.939					
LAB-14 (VOL.)	.901	.901	.939	.901	.901	.875					
LAB-16 (A.A.)	.936	.936	.936	.936	.900	.900					
LAB-17 (XRF)	.774	.792	.792	.801							
LAB-17 (POTEN.)	.837	.900									
LAB-17 (SPECTR.1)	.870	.800	.910	.950	1.000	.950					
LAB-17 (SPECTR.2)	.910	.870	.800	.780	.720	.890					
LAB-21 (XRF)	.980	1.000	.970	.960	.970	.850	.870	.940	.870	1.010	
LAB-21 (A.A.)	.960	.960	.940	.940	.960	.960	.930	.930			

Table 1(g)

MnO results for SL-1

MNO (WEIGHT PERCENT)

										SAMPLE WT. G
* LAB- 2	1.080	1.070	1.080	1.060	1.080	1.070	1.080	1.070		
LAB- 3 (A.A.)	.960	.950								
LAB- 4	.760	.760	.770	.760	.770	.770				
LAB- 5 (COLOR.)	.830	.830	.810	.800	.800	.820				
LAB- 6	.950	.970	.930	.950	.880	.880				
LAB- 7	.823	.831	.825	.822	.826	.828				
LAB- 9 (A.A.)	.850	.850	.850	.850	.850	.850				
LAB-10 (COLOR.)	.840	.840	.850	.840	.850	.840				
LAB-10 (A.A.)	.850	.850	.850	.850	.880	.850				
LAB-11 (COLOR.)	.900	.920	.920	.940	.900	.880	.900	.930		
LAB-12 (COLOR.)	.850	.840	.840	.860	.840	.840				
LAB-13 (A.A.)	.880	.860	.880	.860	.870	.870				
LAB-14 (VOL.)	.820	.770	.770	.790	.790	.820				
LAB-16 (A.A.)	.878	.878	.881	.873	.878	.873	.891	.884	.872	.884
	.872	.878								
* LAB-17 (XRF)	.710	.690	.720	.700						
LAB-17 (A.A.)	.830	.830								
LAB-17 (SPECTR.1)	.880	.870	.920	.890	.940	.960				
LAB-17 (SPECTR.2)	.800	.800	.770	.760	.750	.800				
LAB-21 (XRF)	.920	.940	.940	.930	.930	.910	.920	.930	.920	.940
LAB-21 (A.A.)	.860	.860	.850	.850	.850	.860	.850	.850		

Table 1(h)

S results for SL-1

	SULPHUR (WEIGHT PERCENT)										SAMPLE WT. G
LAB- 2	1.31	1.30	1.31	1.32	1.33	1.30	1.36	1.34			
LAB- 4	1.28	1.32	1.36	1.32	1.27	1.24					
LAB- 5 (GRAV.)	1.23	1.25	1.22	1.23	1.24	1.25					
LAB- 6	1.19	1.14	1.17	1.17	1.17	1.18					
LAB- 7	1.25	1.27	1.26	1.25	1.25	1.26					
LAB- 9 (COMB.)	1.23	1.21	1.22	1.16	1.18	1.16					
LAB-10 (GRAV.)	1.28	1.29	1.29	1.29	1.30	1.29					
LAB-10 (COMB.)	1.30	1.20	1.30	1.28	1.30	1.28					
LAB-11 (GRAV.)	1.26	1.31	1.26	1.28	1.27	1.31	1.25	1.29	1.24	1.28	
	1.26										
LAB-12 (COMB.)	1.25	1.21	1.25	1.26	1.24	1.26					
LAB-12 (GRAV.)	1.15	1.20	1.17	1.18	1.16	1.19					
LAB-13 (COMB.)	1.25	1.26	1.26	1.26	1.25	1.25					
LAB-14 (GRAV.)	1.27	1.25	1.28	1.27	1.26	1.27					
LAB-16 (COMB.)	1.29	1.29	1.28	1.28	1.29	1.28					
~~LAB-17 (XRF)~~	~~.74~~	~~.83~~	~~.70~~	~~.83~~							
LAB-17 (COMB.)	1.16	1.16									
LAB-21 (GRAV.)	1.21	1.26	1.22	1.28							
LAB-21 (COMB.)	1.32	1.32	1.34	1.34							

Table 1(i)

P_2O_5 results for SL-1

P205 (WEIGHT PERCENT)

									SAMPLE WT. G
LAB- 2	.0060	.0080	.0070	.0070	.0050	.0060	.0060	.0070	
LAB- 4	.0290	.0340	.0260	.0460	.0340	.0460			
LAB- 7	.0060	.0050	.0050	.0060					
LAB-10 (COLOR.)	.0011	.0011	.0009	.0011	.0011	.0010	.0009	.0009	.0007
LAB-12 (COLOR.)	.0320	.0270	.0320	.0270	.0320	.0320			
LAB-13 (VOL.)	.0180	.0180	.0190	.0190	.0200	.0180			
LAB-14 (VOL.)	.0300	.0200	.0300	.0300	.0400	.0400			
LAB-16 (COLOR.)	.0200	.0200	.0200	.0200	.0200	.0200			
LAB-17 (XRF)	.0500	.0300	.0400	.0300					

Table 1(j)

V_2O_5 results for SL-1

V2O5 (WEIGHT PERCENT)

								SAMPLE WT. G
LAB- 2	.048	.047	.049	.048	.048	.050	.049	.050
LAB- 3 (A.A.)	.042	.046						
~~LAB- 7~~	~~.120~~	~~.120~~						
LAB-10 (COLOR.)	.003	.004	.003	.003	.004	.003		
LAB-11 (COLOR.)	.007	.004	.005	.004				
LAB-13 (A.A.)	.005	.005	.005	.005	.005	.005		
LAB-17 (SPECTR.1)	.006	.006	.006	.007	.008	.007		
LAB-17 (SPECTR.2)	.005	.004	.004	.003	.004	.004		

Table 1(k)

Na_2O results for SL-1

NA2O (WEIGHT PERCENT)

							SAMPLE WT. G	
LAB- 2	.310	.300	.320	.310	.310	.320	.310	.310
LAB- 3 (A.A.)	.430	.420						
LAB- 4 (A.A.)	.338	.359	.337	.344	.329	.340		
LAB- 5 (A.A.)	.380	.400	.400	.400	.380	.410		
LAB- 9 (A.A.)	.320	.320	.320	.320	.320	.320		
LAB-10 (A.A.)	.490	.490	.490	.490	.490	.490		
LAB-11 (FLAME)	.315	.320	.320	.315	.310	.315	.315	.320
LAB-12 (A.A.)	.460	.420	.430	.460	.420	.410		
LAB-13 (FLAME)	.460	.460	.460	.460	.460	.460		
LAB-14 (FLAME)	.390	.420	.400	.390	.390	.400		
~~LAB-17 (XRF)~~	~~.700~~	~~.600~~	~~.800~~	~~.500~~				
LAB-17 (A.A.)	.380	.320						
LAB-17 (SPECTR.)	.460	.440	.450	.420	.450	.440		

Table 1(1)

K_2O results for SL-1

K2O (WEIGHT PERCENT)

										SAMPLE WT. G
LAB- 2	.440	.420	.440	.440	.440	.450	.430	.440		
LAB- 3 (A.A.)	.440	.450								
LAB- 4 (A.A.)	.622	.597	.603	.609	.591	.634				
LAB- 5 (A.A.)	.470	.510	.480	.480	.480	.500				
LAB- 7	.530	.590								
* LAB- 9 (A.A.)	.330	.350	.340	.340	.340	.350				
LAB-10 (A.A.)	.510	.510	.510	.510	.510	.520				
LAB-11 (FLAME)	.500	.500	.495	.495	.490	.500	.490	.500		
LAB-12 (A.A.)	.470	.470	.470	.500	.460	.460				
LAB-13 (FLAME)	.520	.520	.520	.520	.520	.520				
LAB-14 (FLAME)	.490	.450	.490	.450	.490	.490				
LAB-17 (XRF)	.590	.640	.640	.620						
LAB-17 (A.A.)	.540	.530								
LAB-22 (XRF)	.500	.510	.510	.520	.500	.500	.490	.490	.480	.500

Table 1(m)

Cr_2O_3 results for SI-1

CR203 (WEIGHT PERCENT)

						SAMPLE WT. G
* LAB- 3 (A.A.)	.0500	.0600				
LAB- 4 (A.A.)	.0040	.0030	.0030	.0070	.0040	.0070
LAB- 9 (A.A.)	.0300	.0300	.0300	.0300	.0300	.0300
LAB-10 (COLOR.)	.0047	.0048	.0048	.0048	.0048	.0047
LAB-10 (A.A.)	.0053	.0050	.0051	.0050	.0050	.0050
LAB-11 (COMPL.)	.0140	.0130	.0130	.0130		
LAB-12 (A.A.)	.0060	.0060	.0060	.0060	.0060	.0060
LAB-13 (A.A.)	.0080	.0070	.0080	.0080	.0070	.0070
~~LAB-16 (A.A.)~~	~~.5600~~	~~.5700~~	~~.5700~~	~~.5300~~	~~.5700~~	~~.5500~~
LAB-17 (SPECTR.1)	.0020	.0020	.0020	.0020	.0030	.0030
LAB-17 (SPECTR.2)	.0040	.0050	.0050	.0060	.0050	.0060

Table 1(n)

FeO results for SL-1

FEO (FERROUS) (WEIGHT PERCENT)

							SAMPLE WT. G
LAB- 5 (VOL.)	.72	.72					
LAB-13 (VOL.)	.70	.70	.70	.70	.70	.70	
LAB-14 (VOL.)	.75	.73	.72	.73	.70	.67	
LAB-17 (POTEN.)	.65	.69					

STANDARD REFERENCE MATERIAL SL-1. SILICA

Table 2(a)

SILICA CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	35.9425	.0450	4	36.0250	.1287	A	8	35.9838	.0996	.28
LAB- 4		3	35.8200	.1510	3	35.7800	.0200	A	6	35.8000	.0988	.28
LAB- 5	(GRAV.)	3	35.8100	.2916	3	35.8933	.0115	A	6	35.8517	.1840	.51
LAB- 6		3	35.1900	.0600	3	35.5633	.0058	REJECT	6	35.3717	.2134	.60
LAB- 7		3	35.9267	.1002	3	36.0067	.0208	A	6	35.9667	.0781	.22
LAB- 9	(GRAV.)	3	35.7067	.0462	3	35.6800	.0346	A	6	35.6933	.0393	.11
LAB-10	(GRAV.)	3	36.0667	.0577	3	36.0667	.0577	A	6	36.0667	.0516	.14
LAB-11	(GRAV.)	4	35.6250	.0500	4	35.7500	.0577	REJECT	8	35.6875	.0835	.23
LAB-12	(GRAV.)	3	35.6467	.0473	3	35.6633	.0666	A	6	35.6550	.0524	.15
LAB-13	(GRAV.)	3	35.8867	.0306	3	35.8800	.0200	A	6	35.8833	.0234	.07
LAB-14	(GRAV.)	3	35.5300	.0794	3	35.5600	.0656	A	6	35.5450	.0672	.19
LAB-16	(GRAV.)	3	35.5100	.0529	3	35.5533	.0252	A	6	35.5317	.0440	.12
LAB-16	(A.A.)	3	35.6000	.1732	3	35.4333	.1155	A	6	35.5167	.1602	.45
LAB-17	(XRF)	2	35.7000	0.0000	2	35.0500	.2121	***R**	4	35.3750	.3948	1.12
LAB-17	(GRAV.)	INSUFFICIENT DATA							2	36.2200	.0283	.08
LAB-21	(XRF)	5	35.8960	.0773	5	36.0600	.1310	REJECT	10	35.9780	.1332	.37
LAB-21	(A.A.)	2	35.4750	.3889	2	35.5900	.0424	A	4	35.5325	.2354	.66
LAB-21	(GRAV.)	2	35.2700	.0424	2	35.3900	.1273	A	4	35.3300	.1039	.29
								TOTAL	106	35.7342	.2645	.74

Note - Entries marked * are "statistical" outliers

STANDARD REFERENCE MATERIAL SL-1. LIME

Table 2(b)

LIME CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	37.0450	.0915	4	36.9550	.0208	A	8	37.0000	.0780	.21
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	38.1300	.0990	.26
LAB- 4		3	38.5000	0.0000	3	38.3333	.2887	A	6	38.4167	.2041	.53
LAB- 5	(VOL.)	3	37.5600	.1039	3	37.4733	.1518	A	6	37.5167	.1256	.33
LAB- 6		3	37.5600	.0800	3	37.4800	.0200	A	6	37.5200	.0681	.18
LAB- 7		3	37.1800	.0265	3	37.2833	.0153	REJECT	6	37.2317	.0598	.16
LAB-10	(VOL.)	3	37.3667	.0577	3	37.3667	.0577	A	6	37.3667	.0516	.14
LAB-10	(A.A.)	3	37.4333	.2887	3	37.6000	0.0000	A	6	37.5167	.2041	.54
LAB-11	(COMPL.)	5	37.2800	.2010	4	37.2400	.2661	A	9	37.2622	.2172	.58
LAB-11		5	37.1080	.0228	5	37.1200	.0200	A	10	37.1140	.0212	.06
LAB-12	(GRAV.)	3	37.6833	.2120	3	37.7033	.0153	A	6	37.6933	.1349	.36
LAB-13	(VOL.)	3	37.8333	.0577	3	37.7667	.0577	A	6	37.8000	.0632	.17
LAB-14	(VOL.)	3	38.3000	.0000	3	38.2333	.0577	A	6	38.2667	.0516	.13
LAB-16	(GRAV.)	3	37.5200	.0755	3	37.3867	.0416	A	6	37.4533	.0911	.24
LAB-16	(A.A.)	3	37.4000	0.0000	3	37.3333	.1155	A	6	37.3667	.0816	.22
* LAB-17	(XRF)	2	36.0500	.0707	2	35.9500	.2121	A	4	36.0000	.1414	.39
LAB-17	(A.A.)	INSUFFICIENT DATA							2	36.5500	.0707	.19
LAB-18		6	36.8483	.1120	6	36.9800	.0587	REJECT	12	36.9142	.1095	.30
LAB-20	(A.A.)	5	37.4800	.0837	5	37.5000	.1414	A	10	37.4900	.1101	.29
LAB-21	(XRF)	5	37.3300	.2556	5	36.9480	.3152	A	10	37.1390	.3373	.91
LAB-21	(GRAV.)	2	36.9500	.0424	2	36.9750	.0354	A	4	36.9625	.0350	.09
LAB-22	(XRF)	5	37.6080	.1112	5	37.8200	.1306	REJECT	10	37.7140	.1599	.42
LAB-22	(VOL.)	5	37.6940	.1553	5	37.748[illegible]	.0867	A	10	37.7210	.1220	.32
LAB-23	(VOL.)	5	37.6380	.0449	5	37.5500	.0453	REJECT	10	37.5940	.0629	.17
LAB-24	(GRAV.)	5	38.1360	.3245	5	37.8600	.2760	A	10	37.9980	.3191	.84
LAB-25	(GRAV.)	5	37.3840	.0378	5	37.3980	.0438	A	10	37.3910	.0393	.11
								TOTAL	187	37.4441	.4583	1.22

STANDARD REFERENCE MATERIAL SL-1, MAGNESIA

Table 2(c)

MAGNESIA CONCENTRATION, %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	12.3925	.0435	4	12.4500	.1074	A	8	12.4213	.0818	.66
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	12.2300	.0424	.35
LAB- 4		3	11.8800	.0000	3	11.8800	.0000	A	6	11.8800	.0000	.00
LAB- 5	(GRAV.)	3	11.9600	.1852	3	12.0067	.0115	A	6	11.9833	.1201	1.00
LAB- 6		3	11.9333	.1550	3	11.6267	.0416	REJECT	6	11.7800	.1963	1.67
LAB- 7		3	11.8633	.0321	3	11.8833	.0252	A	6	11.8733	.0280	.24
LAB- 9	(A.A.)	3	12.2333	.0577	3	12.2667	.1155	A	6	12.2500	.0837	.68
LAB-10	(GRAV.)	3	12.6000	.0000	3	12.6333	.0577	A	6	12.6167	.0408	.32
LAB-10	(A.A.)	3	12.4000	.0000	3	12.4000	.0000	A	6	12.4000	.0000	.00
LAB-11	(COMPL.)	6	12.8733	.0898	6	12.9917	.2170	A	12	12.9325	.1700	1.31
LAB-11		5	12.6040	.0404	5	12.5560	.0270	A	10	12.5800	.0411	.33
LAB-12	(GRAV.)	3	12.7433	.0208	3	12.6667	.1115	A	6	12.7050	.0831	.65
LAB-13	(A.A.)	3	12.1600	.1905	3	12.0500	.1905	A	6	12.1050	.1807	1.49
LAB-14	(GRAV.)	3	12.3967	.0289	3	12.4300	.0300	A	6	12.4133	.0320	.26
LAB-14	(GRAV.)	3	12.1467	.0569	3	12.2200	.0173	A	6	12.1833	.0550	.45
LAB-14	(A.A.)	3	12.1000	.0000	3	12.2000	.0000	***R**	6	12.1500	.0548	.45
* LAB-17	(XRF)	2	13.1500	.0707	2	13.1500	.2121	A	4	13.1500	.1291	.98
LAB-17	(A.A.)	INSUFFICIENT DATA							2	11.6900	.0141	.12
LAB-18		6	11.9933	.1405	6	11.9300	.1543	A	12	11.9617	.1445	1.21
LAB-20	(A.A.)	5	12.1400	.0548	5	12.1600	.0548	A	10	12.1500	.0527	.43
LAB-21	(XRF)	5	12.1200	.1628	5	12.1920	.0993	A	10	12.1560	.1327	1.09
LAB-21	(A.A.)	2	12.2700	.1131	2	12.2300	.0566	A	4	12.2500	.0766	.63
LAB-21	(GRAV.)	2	12.3750	.0071	2	12.4150	.0071	REJECT	4	12.3950	.0238	.19
LAB-22	(XRF)	5	11.7000	.1345	5	12.0960	.1218	REJECT	10	11.8980	.2412	2.03
LAB-22	(VOL.)	5	11.6780	.1438	5	12.0640	.0932	REJECT	10	11.8710	.2333	1.97
LAB-23	(VOL.)	5	12.6120	.0502	5	12.5420	.0497	A	10	12.5770	.0598	.48
LAB-24	(GRAV.)	5	12.8800	.3388	5	12.8520	.3238	A	10	12.8660	.3128	2.43
LAB-25	(GRAV.)	5	12.1200	.0997	5	12.0260	.0740	A	10	12.0730	.0965	.80
								TOTAL	200	12.2843	.3822	3.11

STANDARD REFERENCE MATERIAL SL-1. ALUMINA

Table 2(d)

ALUMINA CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	9.9475	.0506	4	9.9950	.1936	A	8	9.9713	.1335	1.34
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	9.4050	.0919	.98
LAB- 4		3	9.4533	.4272	3	9.5467	.2540	A	6	9.5000	.3185	3.35
LAB- 5	(GRAV.)	3	9.5300	.0624	3	9.5500	.0721	A	6	9.5400	.0613	.64
LAB- 7		3	9.6533	.0153	3	9.6567	.0208	A	6	9.6550	.0164	.17
*LAB- 9	(A.A.)	3	8.9667	.0577	3	9.0667	.1155	A	6	9.0167	.0983	1.09
LAB-10	(GRAV.)	3	9.6000	0.0000	3	9.6000	0.0000	***R**	6	9.6000	.0000	.00
LAB-10	(A.A.)	3	9.6000	0.0000	3	9.6000	0.0000	***R**	6	9.6000	.0000	.00
LAB-11	(COMPL.)	4	9.7900	.0283	4	9.7900	.0283	A	8	9.7900	.0262	.27
LAB-12	(GRAV.)	3	9.6133	.0321	3	9.6100	.0624	A	6	9.6117	.0445	.46
LAB-13	(A.A.)	3	9.4000	.1000	3	9.3300	.1572	A	6	9.3650	.1239	1.32
LAB-14	(VOL.)	3	9.6167	.1041	3	9.5000	0.0000	A	6	9.5583	.0917	.96
LAB-16	(A.A.)	3	9.6333	.0493	3	9.6367	.0462	A	6	9.6350	.0428	.44
LAB-17	(XRF)	2	9.8550	.3465	2	9.4450	.2758	A	4	9.6500	.3484	3.61
LAB-17	(A.A.)	INSUFFICIENT DATA							2	9.5200	0.0000	0.00
LAB-21	(XRF)	5	9.6160	.0594	5	9.6900	.1151	A	10	9.6530	.0948	.98
LAB-21	(GRAV.)	2	9.5900	.1273	2	9.5600	.0283	A	4	9.5750	.0772	.81
LAB-22	(XRF)	5	9.6760	.0586	5	9.7020	.0923	A	10	9.6890	.0742	.77
								TOTAL	108	9.5995	.2258	2.35

STANDARD REFERENCE MATERIAL SL-1. TITANIA

Table 2(e)

TITANIA CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	.3725	.0050	4	.3725	.0126	A	8	.3725	.0089	2.38
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	.4150	.0071	1.70
LAB- 5	(COLOR.)	3	.3633	.0058	3	.3600	0.0000	A	6	.3617	.0041	1.13
LAB- 7		2	.3300	0.0000	2	.3300	0.0000	***R**	4	.3300	.0000	.00
LAB-10	(COLOR.)	3	.3600	0.0000	3	.3600	0.0000	***R**	6	.3600	0.0000	0.00
LAB-11	(COLOR.)	6	.4100	.0110	6	.4200	.0000	***R**	12	.4150	.0090	2.19
LAB-12	(COLOR.)	3	.4100	.0100	3	.4100	.0000	A	6	.4100	.0063	1.54
LAB-13	(COLOR.)	3	.3700	.0100	3	.3667	.0153	A	6	.3683	.0117	3.17
LAB-14	(COLOR.)	3	.3733	.0058	3	.3700	.0000	A	6	.3717	.0041	1.10
LAB-16	(COLOR.)	3	.3567	.0058	3	.3633	.0058	A	6	.3600	.0063	1.76
LAB-16	(A.A.)	3	.3800	.0000	3	.3800	.0000	A	6	.3800	.0000	.00
* LAB-17	(XRF)	2	.2750	.0071	2	.2700	0.0000	A	4	.2725	.0050	1.83
LAB-17	(A.A.)	INSUFFICIENT DATA							2	.3350	.0071	2.11
LAB-17	(SPECTR.1)	3	.3700	.0000	3	.4033	.0153	***R**	6	.3867	.0207	5.34
LAB-17	(SPECTR.2)	3	.4233	.0058	3	.4133	.0115	A	6	.4183	.0098	2.35
LAB-21	(XRF)	5	.3740	.0055	5	.3700	.0071	A	10	.3720	.0063	1.70
LAB-21	(COLOR.)	4	.3300	.0082	4	.3400	.0163	A	8	.3350	.0131	3.91
								TOTAL	104	.3728	.0340	9.11

STANDARD REFERENCE MATERIAL SL-1. TOTAL IRON AS FEO

Table 2(f)

FEO CONCENTRATION, %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	1.1125	.0435	4	1.0850	.0129	A	8	1.0988	.0331	3.02
* LAB- 3	(A.A.)	INSUFFICIENT DATA							2	1.2450	.0071	.57
LAB- 4		3	.9700	0.0000	3	1.0100	.0346	A	6	.9900	.0310	3.13
LAB- 5	(VOL.)	3	.8877	.0591	3	.8880	.0225	A	6	.8878	.0400	4.51
LAB- 6		3	1.1400	0.0000	3	.9167	.0058	***R**	6	1.0283	.1224	11.90
LAB- 7		2	.8750	0.0000	2	.8750	0.0000	***R**	4	.8750	0.0000	0.00
* LAB- 8	(VOL.)	3	1.2433	.0739	3	1.2433	.0739	A	6	1.2433	.0661	5.32
* LAB- 9	(A.A.)	3	1.2307	.0150	3	1.2523	.0199	A	6	1.2415	.0197	1.59
LAB-10	(A.A.)	3	.8967	.0058	3	.8933	.0058	A	6	.8950	.0055	.61
LAB-11	(COLOR.)	6	.8983	.0075	6	.9017	.0041	A	12	.9000	.0060	.67
LAB-12	(VOL.)	3	.8867	.0115	3	.8733	.0115	A	6	.8800	.0126	1.44
LAB-12	(A.A.)	3	.8833	.0058	3	.8633	.0058	REJECT	6	.8733	.0121	1.39
LAB-13	(A.A.)	3	.9260	.0130	3	.9390	.0130	A	6	.9325	.0136	1.46
LAB-14	(VOL.)	3	.9137	.0219	3	.8923	.0150	A	6	.9030	.0205	2.27
LAB-16	(A.A.)	3	.9360	.0000	3	.9120	.0208	A	6	.9240	.0186	2.01
LAB-17	(XRF)	2	.7830	.0127	2	.7965	.0064	A	4	.7898	.0113	1.43
LAB-17	(POTEN.)	INSUFFICIENT DATA							2	.8685	.0445	5.13
LAB-17	(SPECTR.1)	3	.8600	.0557	3	.9667	.0289	REJECT	6	.9133	.0706	7.73
LAB-17	(SPECTR.2)	3	.8600	.0557	3	.7967	.0862	A	6	.8283	.0736	8.89
LAB-21	(XRF)	5	.9760	.0152	5	.9080	.0665	A	10	.9420	.0579	6.15
LAB-21	(A.A.)	4	.9500	.0115	4	.9450	.0173	A	8	.9475	.0139	1.47
								TOTAL	128	.9587	.1260	13.14

STANDARD REFERENCE MATERIAL SL-1. MNO

MNO CONCENTRATION, %

Table 2(g)

		BOTTLE 1			BOTTLE 2				OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.	NULL HYPOTH.	N	MEAN	ST.DEV.	C.V.(%)
*LAB- 2		4	1.0725	.0096	4	1.0750	.0058	A	8	1.0738	.0074	.69
LAB- 3	(A.A.)	THERE IS ONLY 1 BOTTLE							2	.9550	.0071	.74
LAB- 4		3	.7633	.0058	3	.7667	.0058	A	6	.7650	.0055	.72
LAB- 5	(COLOR.)	3	.8233	.0115	3	.8067	.0115	A	6	.8150	.0138	1.69
LAB- 6		3	.9500	.0200	3	.9033	.0404	A	6	.9267	.0383	4.13
LAB- 7		3	.8263	.0042	3	.8253	.0031	A	6	.8258	.0033	.40
LAB- 9	(A.A.)	3	.8500	.0000	3	.8500	.0000	A	6	.8500	.0000	.00
LAB-10	(COLOR.)	3	.8433	.0058	3	.8433	.0058	A	6	.8433	.0052	.61
LAB-10	(A.A.)	3	.8500	.0000	3	.8600	.0173	A	6	.8550	.0122	1.43
LAB-11	(COLOR.)	4	.9200	.0163	4	.9025	.0206	A	8	.9112	.0196	2.15
LAB-12	(COLOR.)	3	.8433	.0058	3	.8467	.0115	A	6	.8450	.0084	.99
LAB-13	(A.A.)	3	.8733	.0115	3	.8667	.0058	A	6	.8700	.0089	1.03
LAB-14	(VOL.)	3	.7867	.0289	3	.8000	.0173	A	6	.7933	.0225	2.84
LAB-16	(A.A.)	6	.8768	.0032	6	.8802	.0075	A	12	.8785	.0058	.66
*LAB-17	(XRF)	2	.7000	.0141	2	.7100	.0141	A	4	.7050	.0129	1.83
LAB-17	(A.A.)	INSUFFICIENT DATA							2	.8300	0.0000	0.00
LAB-17	(SPECTR.1)	3	.8900	.0265	3	.9300	.0361	A	6	.9100	.0358	3.93
LAB-17	(SPECTR.2)	3	.7900	.0173	3	.7700	.0265	A	6	.7800	.0228	2.92
LAB-21	(XRF)	5	.9320	.0084	5	.9240	.0114	A	10	.9280	.0103	1.11
LAB-21	(A.A.)	4	.8550	.0058	4	.8525	.0050	A	8	.8538	.0052	.61
								TOTAL	126	.8682	.0778	8.96

STANDARD REFERENCE MATERIAL SL-1. SULPHUR

Table 2(h)

SULPHUR CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	1.3100	.0082	4	1.3325	.0250	A	8	1.3213	.0210	1.59
LAB- 4		3	1.3200	.0400	3	1.2767	.0404	A	6	1.2983	.0431	3.32
LAB- 5	(GRAV.)	3	1.2333	.0153	3	1.2400	.0100	A	6	1.2367	.0121	.98
LAB- 6		3	1.1667	.0252	3	1.1733	.0058	A	6	1.1700	.0167	1.43
LAB- 7		3	1.2600	.0100	3	1.2533	.0058	A	6	1.2567	.0082	.65
LAB- 9	(COMB.)	3	1.2200	.0100	3	1.1667	.0115	REJECT	6	1.1933	.0308	2.58
LAB-10	(GRAV.)	3	1.2867	.0058	3	1.2933	.0058	A	6	1.2900	.0063	.49
LAB-10	(COMB.)	3	1.2667	.0577	3	1.2867	.0115	A	6	1.2767	.0388	3.04
LAB-11	(GRAV.)	6	1.2817	.0232	5	1.2640	.0207	A	11	1.2736	.0229	1.80
LAB-12	(COMB.)	3	1.2367	.0231	3	1.2533	.0115	A	6	1.2450	.0187	1.50
LAB-12	(GRAV.)	3	1.1733	.0252	3	1.1767	.0153	A	6	1.1750	.0187	1.59
LAB-13	(COMB.)	3	1.2567	.0058	3	1.2533	.0058	A	6	1.2550	.0055	.44
LAB-14	(GRAV.)	3	1.2667	.0153	3	1.2667	.0058	A	6	1.2667	.0103	.82
LAB-16	(COMB.)	3	1.2867	.0058	3	1.2833	.0058	A	6	1.2850	.0055	.43
LAB-17	(COMB.)	INSUFFICIENT DATA							2	1.1600	0.0000	0.00
LAB-21	(GRAV.)	2	1.2350	.0354	2	1.2500	.0424	A	4	1.2425	.0330	2.66
LAB-21	(COMB.)	2	1.3200	0.0000	2	1.3400	0.0000	***R**	4	1.3300	.0115	.87
								TOTAL	101	1.2562	.0505	4.02

STANDARD REFERENCE MATERIAL SL-1. P205 Table 2(i)

P205 CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	.0070	.0008	4	.0060	.0008	A	8	.0065	.0009	14.24
LAB- 4		3	.0297	.0040	3	.0420	.0069	A	6	.0358	.0084	23.58
LAB- 7		2	.0055	.0007	2	.0055	.0007	A	4	.0055	.0006	10.50
LAB-10	(COLOR.)	5	.0011	.0001	4	.0009	.0001	REJECT	9	.0010	.0001	14.26
LAB-12	(COLOR.)	3	.0303	.0029	3	.0303	.0029	A	6	.0303	.0026	8.51
LAB-13	(VOL.)	3	.0183	.0006	3	.0190	.0010	A	6	.0187	.0008	4.37
LAB-14	(VOL.)	3	.0267	.0058	3	.0367	.0058	A	6	.0317	.0075	23.77
LAB-16	(COLOR.)	3	.0200	0.0000	3	.0200	0.0000	***R**	6	.0200	0.0000	0.00
LAB-17	(XRF)	2	.0400	.0141	2	.0350	.0071	A	4	.0375	.0096	25.53
								TOTAL	55	.0191	.0141	73.50

STANDARD REFERENCE MATERIAL SL-1, V2O5 Table 2(j)

V2O5 CONCENTRATION, %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	.0480	.0008	4	.0493	.0010	A	8	.0486	.0011	2.18
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	.0440	.0028	6.43
LAB-10	(COLOR.)	3	.0033	.0006	3	.0033	.0006	A	6	.0033	.0005	15.49
LAB-11	(COLOR.)	2	.0055	.0021	2	.0045	.0007	A	4	.0050	.0014	28.28
LAB-13	(A.A.)	3	.0050	0.0000	3	.0050	0.0000	***R**	6	.0050	0.0000	0.00
LAB-17	(SPECTR.1)	3	.0060	0.0000	3	.0073	.0006	***R**	6	.0067	.0008	12.25
LAB-17	(SPECTR.2)	3	.0043	.0006	3	.0037	.0006	A	6	.0040	.0006	15.81
								TOTAL	38	.0161	.0192	119.55

STANDARD REFERENCE MATERIAL SL-1. NA2O

Table 2(k)

NA2O CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	.3100	.0082	4	.3125	.0050	A	8	.3113	.0064	2.06
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	.4250	.0071	1.66
LAB- 4	(A.A.)	3	.3447	.0124	3	.3377	.0078	A	6	.3412	.0100	2.94
LAB- 5	(A.A.)	3	.3933	.0115	3	.3967	.0153	A	6	.3950	.0122	3.10
LAB- 9	(A.A.)	3	.3200	0.0000	3	.3200	0.0000	***R**	6	.3200	0.0000	0.00
LAB-10	(A.A.)	3	.4900	.0000	3	.4900	.0000	A	6	.4900	.0000	.00
LAB-11	(FLAME)	4	.3175	.0029	4	.3150	.0041	A	8	.3163	.0035	1.12
LAB-12	(A.A.)	3	.4367	.0208	3	.4300	.0265	A	6	.4333	.0216	4.99
LAB-13	(FLAME)	3	.4600	0.0000	3	.4600	0.0000	***R**	6	.4600	.0000	.00
LAB-14	(FLAME)	3	.4033	.0153	3	.3933	.0058	A	6	.3983	.0117	2.93
LAB-17	(A.A.)	INSUFFICIENT DATA							2	.3500	.0424	12.12
LAB-17	(SPECTR.1)	3	.4500	.0100	3	.4367	.0153	A	6	.4433	.0137	3.08
								TOTAL	68	.3861	.0632	16.35

STANDARD REFERENCE MATERIAL SL-1. K2O

Table 2(1)

K2O CONCENTRATION. %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 2		4	.4350	.0100	4	.4400	.0082	A	8	.4375	.0089	2.03
LAB- 3	(A.A.)	INSUFFICIENT DATA							2	.4450	.0071	1.59
LAB- 4	(A.A.)	3	.6073	.0131	3	.6113	.0216	A	6	.6093	.0161	2.64
LAB- 5	(A.A.)	3	.4867	.0208	3	.4867	.0115	A	6	.4867	.0151	3.09
LAB- 7		INSUFFICIENT DATA							2	.5600	.0424	7.58
LAB- 9	(A.A.)	3	.3400	.0100	3	.3433	.0058	A	6	.3417	.0075	2.20
LAB-10	(A.A.)	3	.5100	.0000	3	.5133	.0058	A	6	.5117	.0041	.80
LAB-11	(FLAME)	4	.4975	.0029	4	.4950	.0058	A	8	.4963	.0044	.89
LAB-12	(A.A.)	3	.4700	.0000	3	.4733	.0231	A	6	.4717	.0147	3.12
LAB-13	(FLAME)	3	.5200	.0000	3	.5200	.0000	A	6	.5200	.0000	.00
LAB-14	(FLAME)	3	.4767	.0231	3	.4767	.0231	A	6	.4767	.0207	4.33
LAB-17	(XRF)	2	.6150	.0354	2	.6300	.0141	A	4	.6225	.0236	3.80
LAB-17	(A.A.)	INSUFFICIENT DATA							2	.5350	.0071	1.32
LAB-22	(XRF)	5	.5080	.0084	5	.4920	.0084	REJECT	10	.5000	.0115	2.31
								TOTAL	78	.4942	.0675	13.65

STANDARD REFERENCE MATERIAL SL-1, CR203 Table 2(m)

CR203 CONCENTRATION, %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
* LAB- 3	(A.A.)	INSUFFICIENT DATA							2	.0550	.0071	12.86
LAB- 4	(A.A.)	3	.0033	.0006	3	.0060	.0017	A	6	.0047	.0019	39.90
LAB- 9	(A.A.)	3	.0300	.0000	3	.0300	.0000	A	6	.0300	.0000	.00
LAB-10	(COLOR.)	3	.0048	.0001	3	.0048	.0001	A	6	.0048	.0001	1.08
LAB-10	(A.A.)	3	.0051	.0002	3	.0050	0.0000	A	6	.0051	.0001	2.39
LAB-11	(COMPL.)	2	.0135	.0007	2	.0130	0.0000	A	4	.0133	.0005	3.77
LAB-12	(A.A.)	3	.0060	0.0000	3	.0060	0.0000	***R**	6	.0060	0.0000	0.00
LAB-13	(A.A.)	3	.0077	.0006	3	.0073	.0006	A	6	.0075	.0005	7.30
LAB-17	(SPECTR.1)	3	.0020	0.0000	3	.0027	.0006	A	6	.0023	.0005	22.13
LAB-17	(SPECTR.2)	3	.0047	.0006	3	.0057	.0006	A	6	.0052	.0008	14.57
								TOTAL	54	.0103	.0120	116.83

STANDARD REFERENCE MATERIAL SL-1. FEO (FERROUS ONLY)

Table 2(n)

FEO CONCENTRATION, %

		BOTTLE 1			BOTTLE 2			NULL HYPOTH.	OVERALL			
		N	MEAN	ST.DEV.	N	MEAN	ST.DEV.		N	MEAN	ST.DEV.	C.V.(%)
LAB- 5	(VOL.)	INSUFFICIENT DATA							2	.7200	0.0000	0.00
LAB-13	(VOL.)	3	.7000	.0000	3	.7000	.0300	A	6	.7000	.0000	.00
LAB-14	(VOL.)	3	.7333	.0153	3	.7000	.0300	A	6	.7167	.0280	3.91
LAB-17	(POTEN.)	INSUFFICIENT DATA							2	.6700	.0283	4.22
								TOTAL	16	.7050	.0239	3.40

TABLE 4

Estimation of Statistical Parameters for SL-1 (After Rejection of Outliers)

Constituent	No. of Labs	No. of Sets	Total No. of Results	Median %	Mean %	95% Conf. Int. of Mean Low, %	95% Conf. Int. of Mean High, %	Spread % of Mean	Average Within-set c.v., %	Certification Factor	Within-set Variance	Between-set Variance	Variance of the Mean	Skewness	Kurtosis
SiO_2	14 (13)	18 (15)	106 (88)	35.75 (35.71)	35.73 (35.73)	35.61 (35.60)	35.86 (35.86)	0.7 (0.7)	0.3 (0.3)	2.1 (2.4)	0.18×10^{-1} (0.17×10^{-1})	0.54×10^{-1} (0.50×10^{-1})	0.34×10^{-2} (0.37×10^{-2})	-0.5 (-0.5)	3.1 (3.5)
CaO	20 (13)	25 (15)	183 (87)	37.47 (37.47)	37.48 (37.54)	37.30 (37.29)	37.65 (37.78)	0.9 (1.3)	0.3 (0.3)	2.9 (4.7)	0.24×10^{-1} (0.16×10^{-1})	0.15×10^{0} (0.18×10^{0})	0.69×10^{-2} (0.13×10^{-1})	0.4 (0.5)	3.2 (3.2)
MgO	21 (14)	27 (16)	196 (96)	12.20 (12.27)	12.27 (12.30)	12.12 (12.09)	12.41 (12.51)	2.4 (3.4)	0.8 (0.6)	3.0 (5.6)	0.20×10^{-1} (0.11×10^{-1})	0.12×10^{0} (0.14×10^{0})	0.51×10^{-2} (0.96×10^{-2})	0.4 (0.3)	3.0 (2.6)
Al_2O_3	14 (12)	17 (14)	102 (78)	9.62 (9.60)	9.63 (9.63)	9.56 (9.53)	9.71 (9.72)	1.6 (2.0)	0.9 (1.0)	1.7 (2.0)	0.15×10^{-1} (0.18×10^{-1})	0.18×10^{-1} (0.23×10^{-1})	0.13×10^{-2} (0.20×10^{-2})	0.0 (0.0)	5.6 (4.8)
TiO_2	12 (11)	16 (14)	100 (82)	0.37 (0.37)	0.38 (0.38)	0.36 (0.36)	0.39 (0.40)	8.3 (8.7)	1.9 (1.8)	4.4 (4.9)	0.83×10^{-4} (0.80×10^{-4})	0.74×10^{-3} (0.70×10^{-3})	0.54×10^{-4} (0.59×10^{-4})	0.1 (0.1)	2.3 (2.0)
Total Iron as FeO	13 (12)	18 (16)	114 (96)	0.90 (0.90)	0.92 (0.92)	0.89 (0.88)	0.96 (0.96)	8.0 (9.4)	3.5 (3.5)	2.2 (2.7)	0.20×10^{-2} (0.20×10^{-2})	0.47×10^{-2} (0.56×10^{-2})	0.31×10^{-3} (0.41×10^{-3})	0.9 (1.0)	4.4 (4.3)
MnO	14 (13)	18 (16)	114 (96)	0.85 (0.85)	0.86 (0.85)	0.83 (0.82)	0.89 (0.88)	6.2 (6.6)	1.4 (1.5)	4.3 (4.4)	0.27×10^{-3} (0.31×10^{-3})	0.25×10^{-2} (0.25×10^{-2})	0.16×10^{-3} (0.18×10^{-3})	0.0 (0.1)	2.6 (2.7)
S	14 (13)	17 (15)	101 (93)	1.26 (1.26)	1.26 (1.25)	1.23 (1.23)	1.28 (1.28)	4.1 (4.3)	1.4 (1.4)	2.9 (3.1)	0.48×10^{-3} (0.47×10^{-3})	0.22×10^{-2} (0.21×10^{-2})	0.15×10^{-3} (0.16×10^{-3})	-0.4 (-0.4)	2.6 (2.7)
Na_2O	11	12	68	0.39	0.39	0.34	0.43	22.4	2.8	7.9	0.13×10^{-3}	0.42×10^{-2}	0.39×10^{-3}	0.2	1.6
K_2O	12 (11)	13 (12)	72 (62)	0.50 (0.50)	0.51 (0.51)	0.47 (0.47)	0.54 (0.55)	13.9 (15.6)	2.6 (2.6)	5.4 (6.0)	0.19×10^{-3} (0.20×10^{-3})	0.28×10^{-2} (0.28×10^{-2})	0.26×10^{-3} (0.32×10^{-3})	1.0 (0.8)	3.5 (3.0)
P_2O_5	9	9	55	0.020	0.019	0.008	0.030	117.2	13.9	8.5	0.21×10^{-4}	0.20×10^{-3}	0.24×10^{-4}	0.3	2.0
V_2O_5	6	7	38	0.005	0.016	0.000	0.036	249.7	11.5	21.7	0.92×10^{-6}	0.43×10^{-3}	0.67×10^{-4}	1.1	2.2
Cr_2O_3	7	9	52	0.006	0.009	0.002	0.015	155.8	10.1	15.4	0.55×10^{-6}	0.75×10^{-4}	0.84×10^{-5}	2.0	5.5
Ferrous Iron as FeO	4	4	16	0.70	0.71	0.67	0.74	9.1	2.0	4.5	0.39×10^{-3}	0.24×10^{-3}	0.10×10^{-3}	-0.4	3.4

STANDARD REFERENCE MATERIAL SL-1. SILICA Table 3(a)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE *
BETWEEN SETS	13	.36152571E+01	.27809670E+00	11.317	2.507
BETWEEN BOTTLES	14	.34403333E+00	.24573810E-01	2.810	1.873
BETWEEN REPLICATES	56	.48973333E+00	.87452381E-02		
TOTAL	83	.44490238E+01			

PSI	=	.20555733E+00
OMEGA	=	.72637390E-01
SIGMA	=	.93515978E-01
GRAND MEAN	=	35.7540

* 95% probability

STANDARD REFERENCE MATERIAL SL-1. LIME Table 3(b)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE*
BETWEEN SETS	21	.17003455E+02	.80968835E+00	20.464	2.059
BETWEEN BOTTLES	22	.87045000E+00	.39565909E-01	1.914	1.664
BETWEEN REPLICATES	88	.18186667E+01	.20666667E-01		
TOTAL	131	.19692572E+02			

PSI = .35826490E+00

OMEGA = .79370949E-01

SIGMA = .14375906E+00

GRAND MEAN = 37.5173

*95% probability

STANDARD REFERENCE MATERIAL SL-1, MAGNESIA Table 3(c)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE *
BETWEEN SETS	22	.14636507E+02	.66529578E+00	17.257	2.025
BETWEEN BOTTLES	23	.88671667E+00	.38552899E-01	2.825	1.647
BETWEEN REPLICATES	92	.12554667E+01	.13646377E-01		
TOTAL	137	.16778691E+02			

PSI	=	.32319831E+00
OMEGA	=	.91116266E-01
SIGMA	=	.11681771E+00
GRAND MEAN	=	12.2421

*95% probability

STANDARD REFERENCE MATERIAL SL-1. ALUMINA Table 3(d)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE*
BETWEEN SETS	12	.13650128E+01	.11375107E+00	26.050	2.604
BETWEEN BOTTLES	13	.56766667E-01	.43666667E-02	.306	1.913
BETWEEN REPLICATES	52	.74246667E+00	.14278205E-01		
TOTAL	77	.21642462E+01			

PSI = .13502123E+00

OMEGA = 0.

SIGMA = .11949144E+00

GRAND MEAN = 9.6238

*95% probability

STANDARD REFERENCE MATERIAL SL-1. TITANIA Table 3(e)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE*
BETWEEN SETS	12	.37771795E-01	.31476496E-02	14.442	2.604
BETWEEN BOTTLES	13	.28333333E-02	.21794872E-03	3.953	1.913
BETWEEN REPLICATES	52	.28666667E-02	.55128205E-04		
TOTAL	77	.43471795E-01			

PSI = .22097137E-01

OMEGA = .73670553E-02

SIGMA = .74248370E-02

GRAND MEAN = .3779

*95% probability

STANDARD REFERENCE MATERIAL SL-1. TOTAL IRON AS FEO Table 3(f)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE *
BETWEEN SETS	14	.40001193E+00	.28572281E-01	3.600	2.424
BETWEEN BOTTLES	15	.11905033E+00	.79366889E-02	9.037	1.836
BETWEEN REPLICATES	60	.52695333E-01	.87825556E-03		
TOTAL	89	.57175760E+00			

PSI = .58645250E-01

OMEGA = .48505784E-01

SIGMA = .29635377E-01

GRAND MEAN = .9299

*95% probability

STANDARD REFERENCE MATERIAL SL-1, MNO Table 3(g)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE *
BETWEEN SETS	15	.22007641E+00	.14671760E-01	28.976	2.352
BETWEEN BOTTLES	16	.81015000E-02	.50634375E-03	2.054	1.804
BETWEEN REPLICATES	64	.15777333E-01	.24652083E-03		
TOTAL	95	.24395524E+00			

PSI = .48589122E-01

OMEGA = .93063225E-02

SIGMA = .15700982E-01

GRAND MEAN = .8528

*95% probability

STANDARD REFERENCE MATERIAL SL-1. SULPHUR Table 3(h)

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE	F-RATIO	F-TABLE *
BETWEEN SETS	13	.15945833E+00	.12256026E-01	17.795	2.507
BETWEEN BOTTLES	14	.96500000E-02	.68928571E-03	1.540	1.873
BETWEEN REPLICATES	56	.25066667E-01	.44761905E-03		
TOTAL	83	.19417500E+00			

PSI = .43925581E-01

OMEGA = .89752747E-02

SIGMA = .21157009E-01

GRAND MEAN = 1.2525

*95% probability

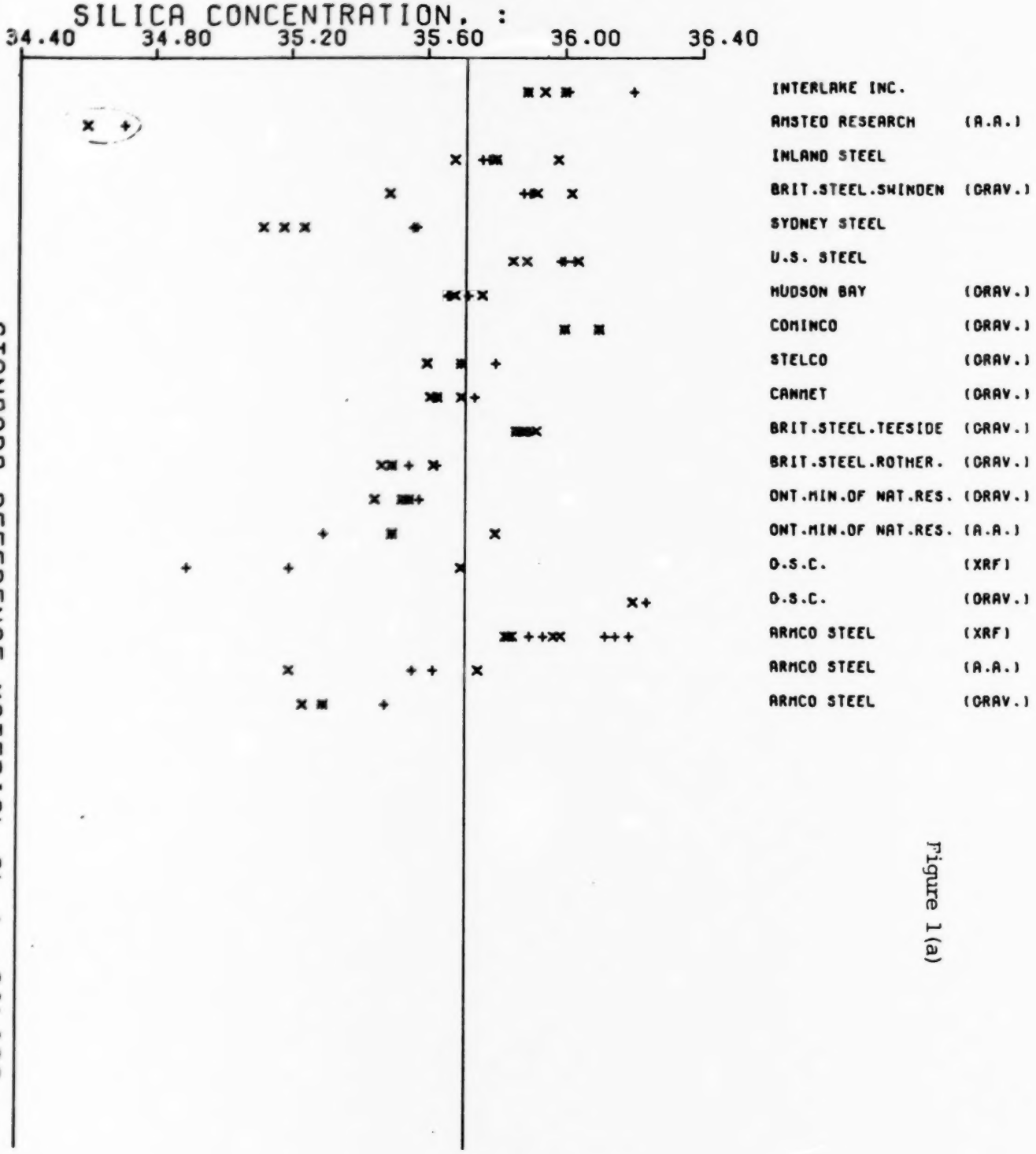
SILICA CONCENTRATION, %
34.40
34.80
35.20
35.60
36.00
36.40
INTERLAKE INC.
AMSTEO RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (GRAV.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (GRAV.)
COMINCO (GRAV.)
STELCO (GRAV.)
CANMET (GRAV.)
BRIT.STEEL.TEESIDE (GRAV.)
BRIT.STEEL.ROTHER. (GRAV.)
ONT.MIN.OF NAT.RES. (GRAV.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (XRF)
O.S.C. (GRAV.)
ARMCO STEEL (XRF)
ARMCO STEEL (A.A.)
ARMCO STEEL (GRAV.)
STANDARD REFERENCE MATERIAL SL-1, SILICA

Figure 1(a)

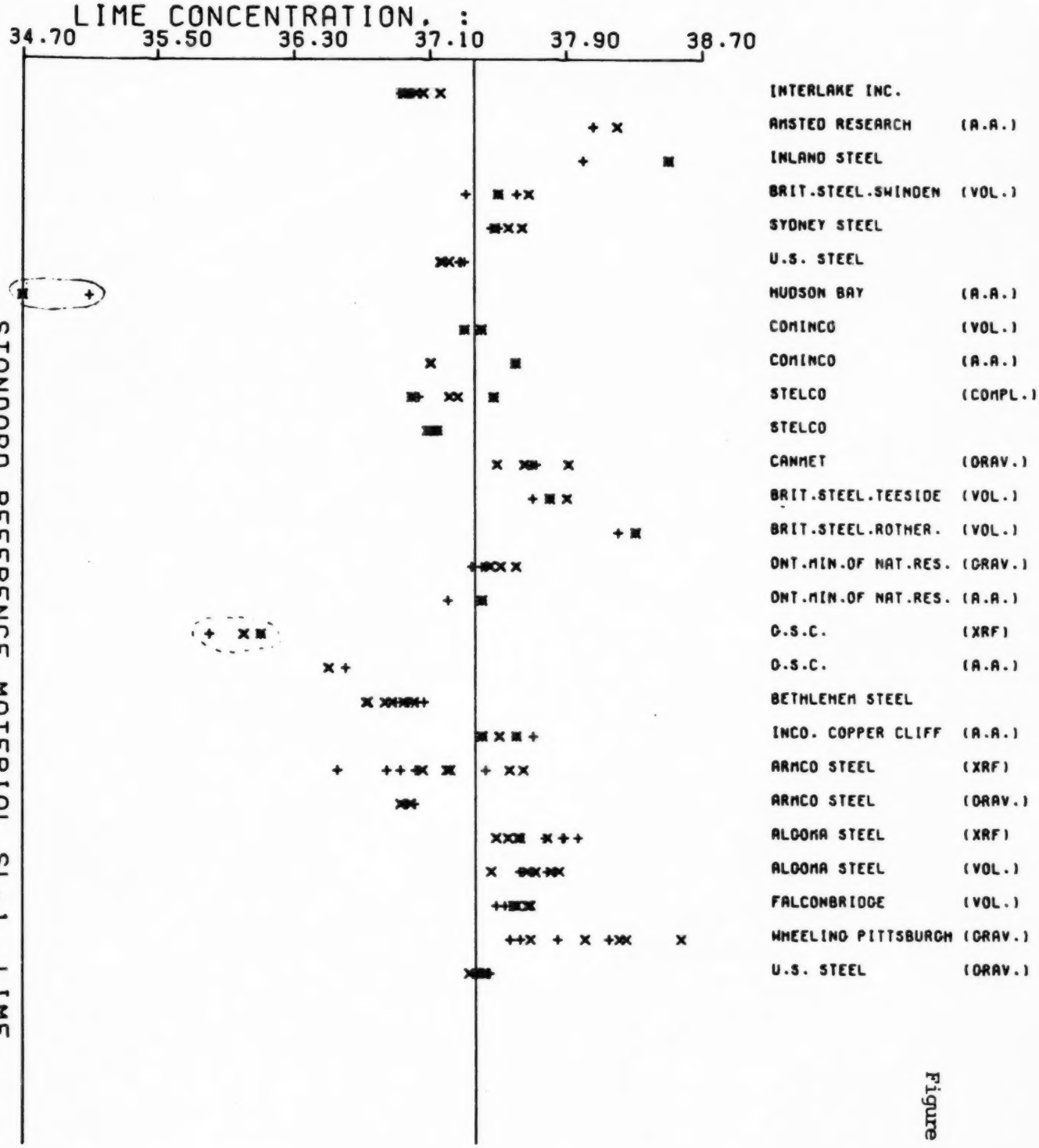
LIME CONCENTRATION, :
34.70
35.50
36.30
37.10
37.90
38.70
STANDARD REFERENCE MATERIAL SL-1, LIME
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (VOL.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (A.A.)
COMINCO (VOL.)
COMINCO (A.A.)
STELCO (COMPL.)
STELCO
CANMET (GRAV.)
BRIT.STEEL.TEESIDE (VOL.)
BRIT.STEEL.ROTHER. (VOL.)
ONT.MIN.OF NAT.RES. (GRAV.)
ONT.MIN.OF NAT.RES. (A.A.)
D.S.C. (XRF)
D.S.C. (A.A.)
BETHLEHEM STEEL
INCO. COPPER CLIFF (A.A.)
ARMCO STEEL (XRF)
ARMCO STEEL (GRAV.)
ALGOMA STEEL (XRF)
ALGOMA STEEL (VOL.)
FALCONBRIDGE (VOL.)
WHEELING PITTSBURGH (GRAV.)
U.S. STEEL (GRAV.)

Figure 1(b)

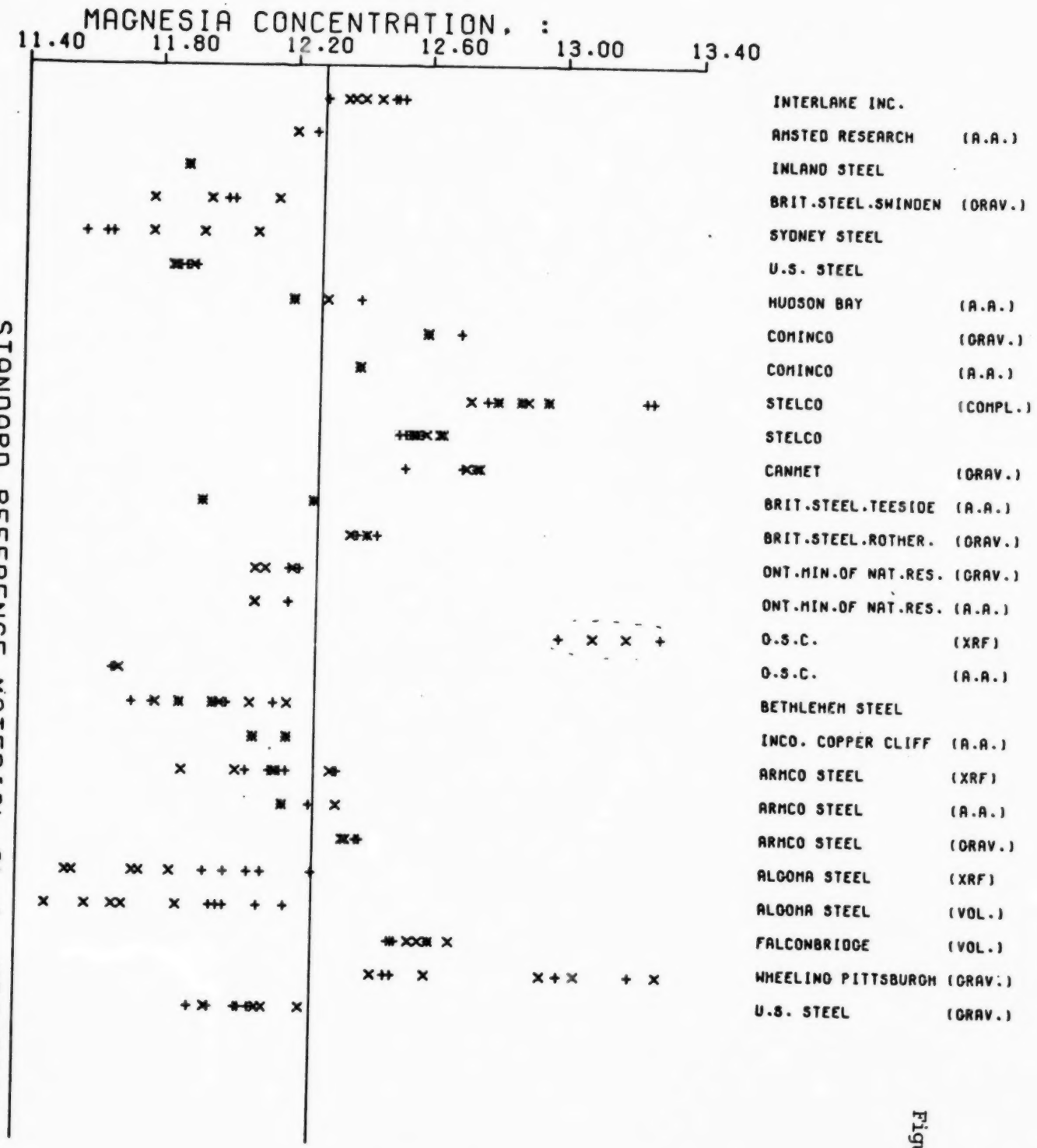
MAGNESIA CONCENTRATION, %
11.40
11.80
12.20
12.60
13.00
13.40
STANDARD REFERENCE MATERIAL SL-1, MAGNESIA
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (GRAV.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (A.A.)
COMINCO (GRAV.)
COMINCO (A.A.)
STELCO (COMPL.)
STELCO
CANMET (GRAV.)
BRIT.STEEL.TEESIDE (A.A.)
BRIT.STEEL.ROTHER. (GRAV.)
ONT.MIN.OF NAT.RES. (GRAV.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (XRF)
O.S.C. (A.A.)
BETHLEHEM STEEL
INCO. COPPER CLIFF (A.A.)
ARMCO STEEL (XRF)
ARMCO STEEL (A.A.)
ARMCO STEEL (GRAV.)
ALGOMA STEEL (XRF)
ALGOMA STEEL (VOL.)
FALCONBRIDGE (VOL.)
WHEELING PITTSBURGH (GRAV.)
U.S. STEEL (GRAV.)

Figure 1(c)

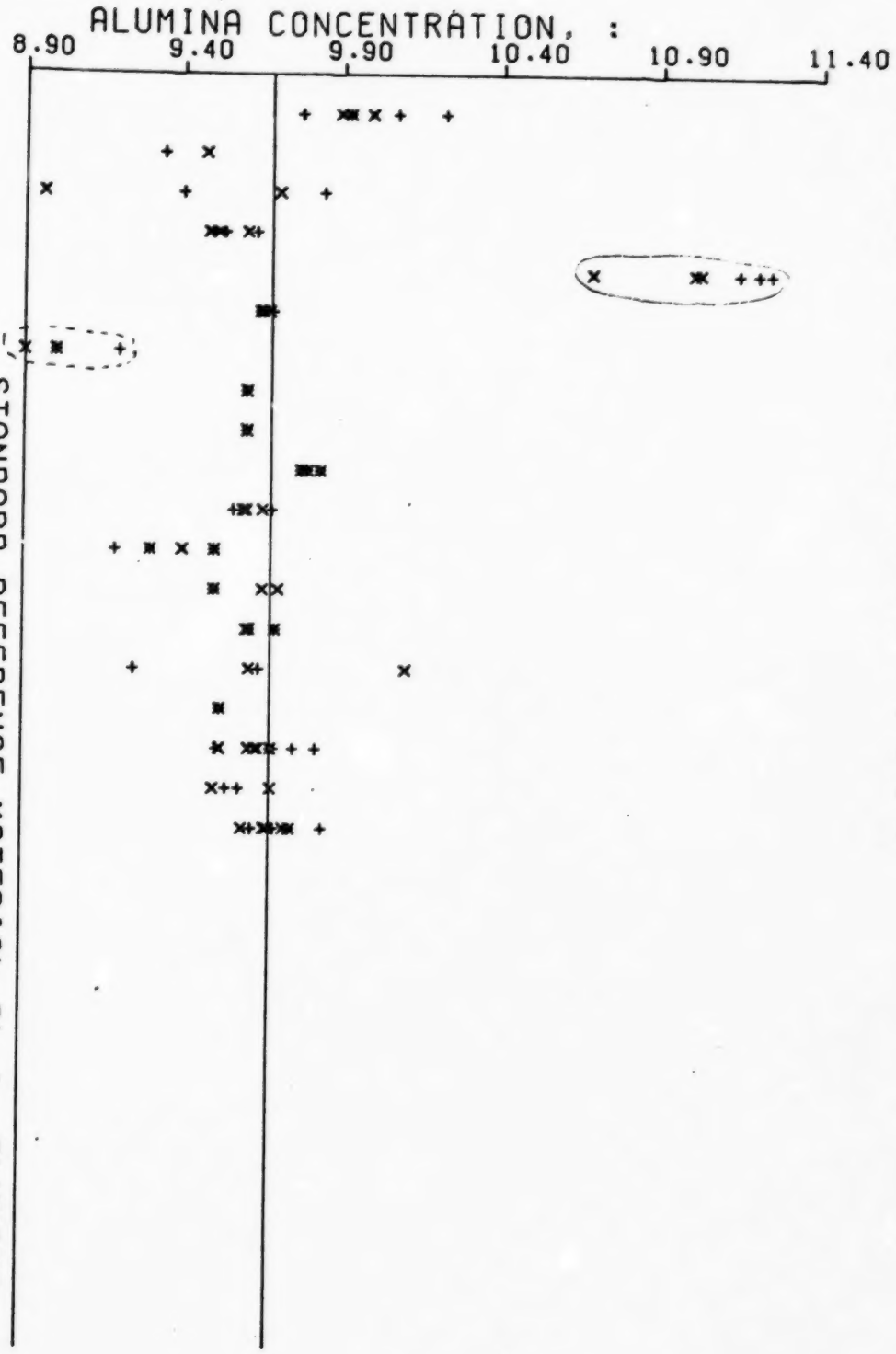
ALUMINA CONCENTRATION, %
8.90
9.40
9.90
10.40
10.90
11.40
STANDARD REFERENCE MATERIAL SL-1, ALUMINA
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (GRAV.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (A.A.)
COMINCO (GRAV.)
COMINCO (A.A.)
STELCO (COMPL.)
CANMET (GRAV.)
BRIT.STEEL.TEESIDE (A.A.)
BRIT.STEEL.ROTHER. (VOL.)
ONT.MIN.OF NAT.RES. (A.A.)
D.S.C. (XRF)
D.S.C. (A.A.)
ARMCO STEEL (XRF)
ARMCO STEEL (GRAV.)
ALGOMA STEEL (XRF)

Figure 1 (d)

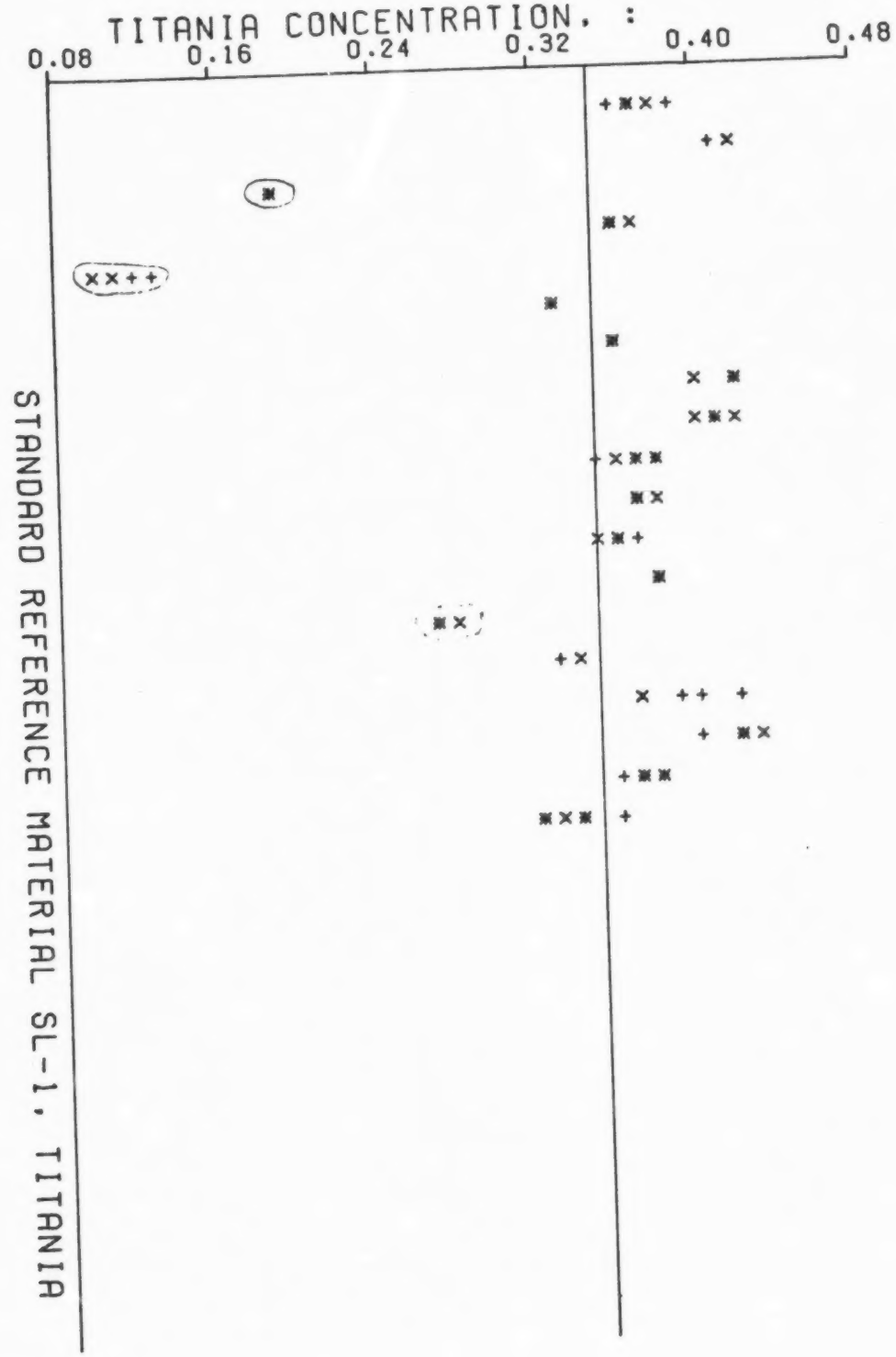
TITANIA CONCENTRATION, %
0.08
0.16
0.24
0.32
0.40
0.48
STANDARD REFERENCE MATERIAL SL-1, TITANIA
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL (A.A.)
BRIT.STEEL.SWINDEN (COLOR.)
SYDNEY STEEL
U.S. STEEL
COMINCO (COLOR.)
STELCO (COLOR.)
CANMET (COLOR.)
BRIT.STEEL.TEESIDE (COLOR.)
BRIT.STEEL.ROTHER. (COLOR.)
ONT.MIN.OF NAT.RES. (COLOR.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (XRF)
O.S.C. (A.A.)
O.S.C. (SPECTR.1)
O.S.C. (SPECTR.2)
ARMCO STEEL (XRF)
ARMCO STEEL (COLOR.)

Figure 1(e)

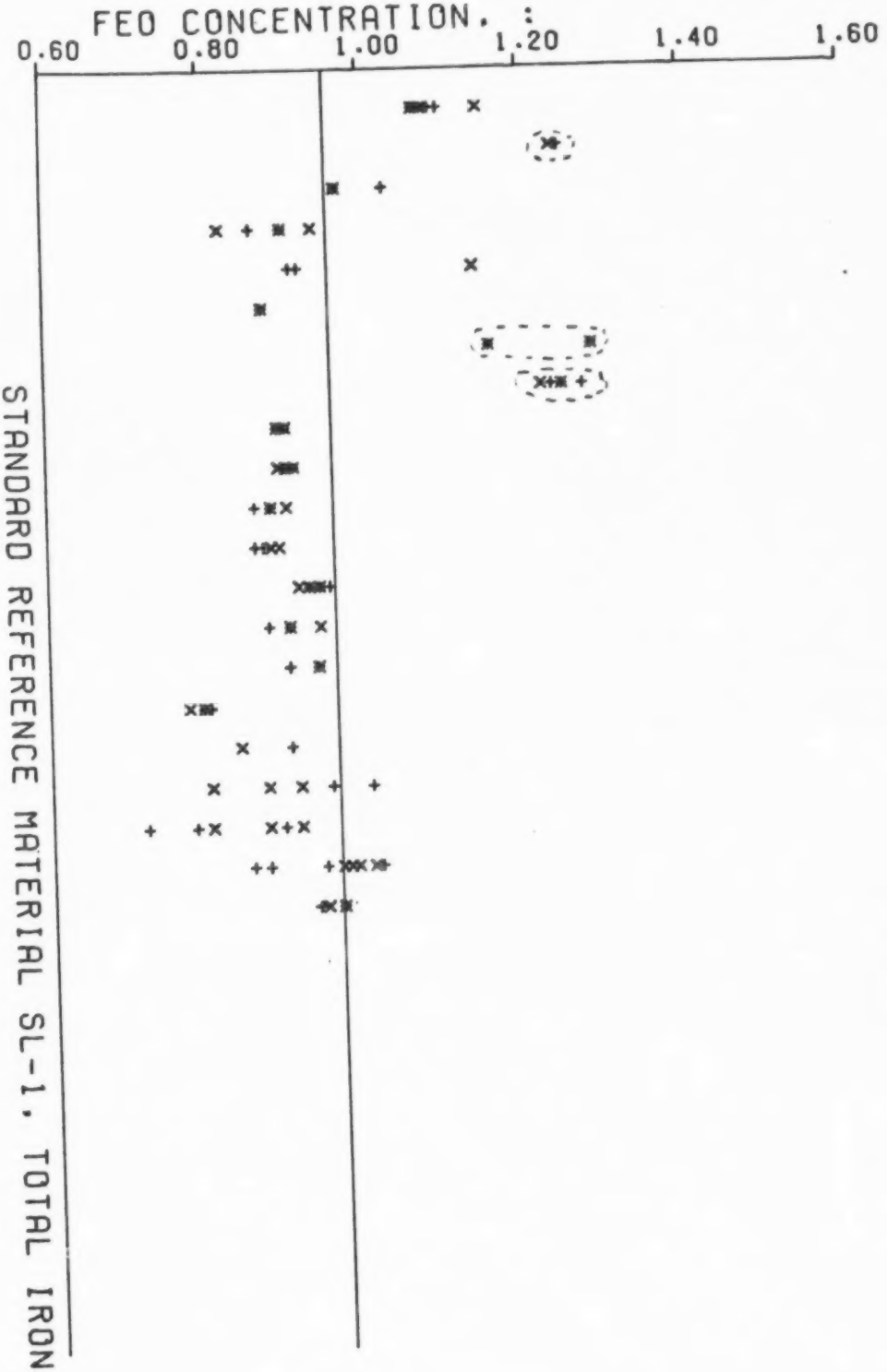
FEO CONCENTRATION, %
0.60
0.80
1.00
1.20
1.40
1.60
STANDARD REFERENCE MATERIAL SL-1, TOTAL IRON AS FEO
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (VOL.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (VOL.)
HUDSON BAY (A.A.)
COMINCO (A.A.)
STELCO (COLOR.)
CANMET (VOL.)
CANMET (A.A.)
BRIT.STEEL.TEESIDE (A.A.)
BRIT.STEEL.ROTHER. (VOL.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (XRF)
O.S.C. (POTEN.)
O.S.C. (SPECTR.1)
O.S.C. (SPECTR.2)
ARMCO STEEL (XRF)
ARMCO STEEL (A.A.)

Figure 1(f)

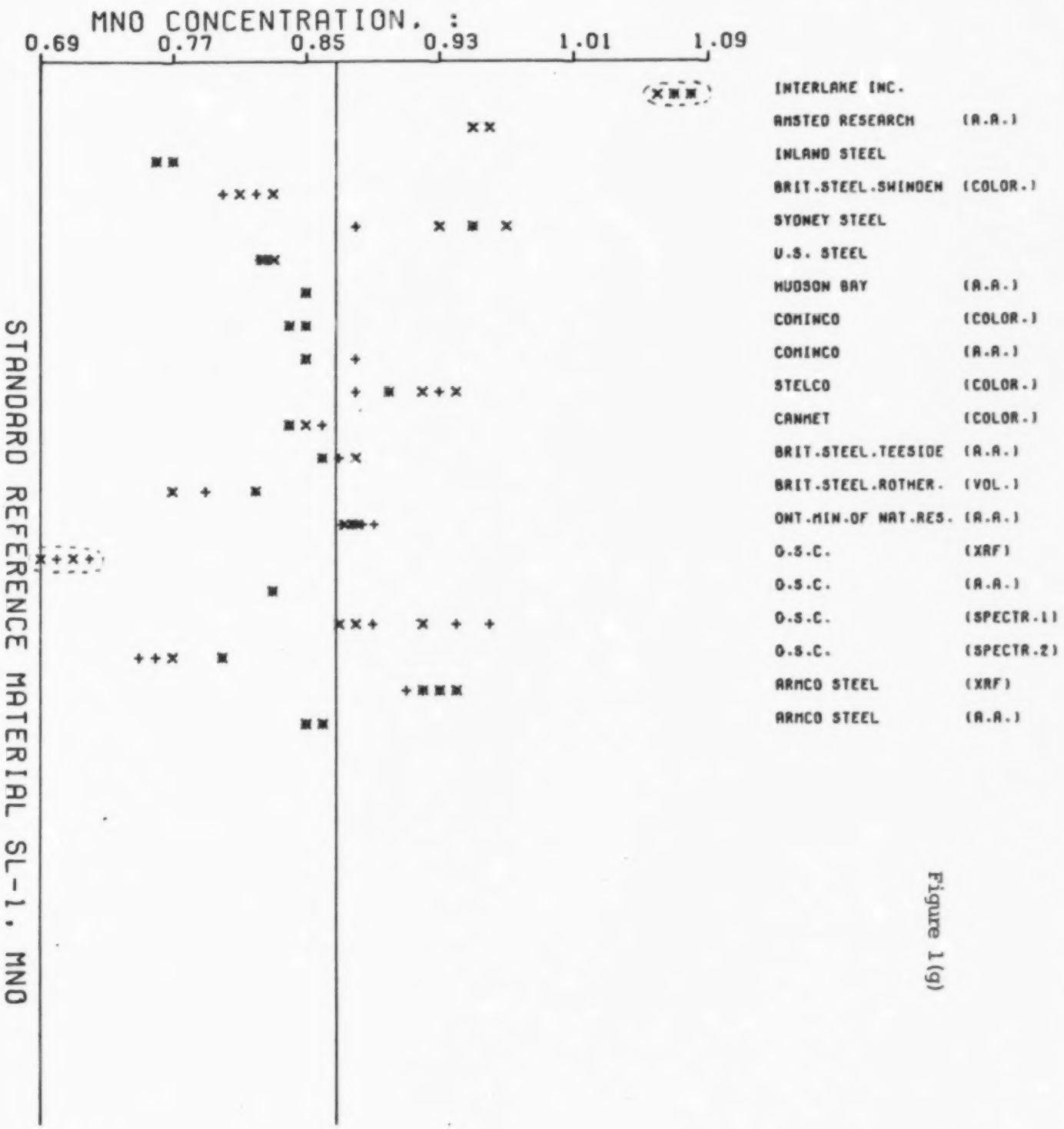
MNO CONCENTRATION, %
0.69
0.77
0.85
0.93
1.01
1.09
STANDARD REFERENCE MATERIAL SL-1, MNO
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL
BRIT.STEEL.SWINDEN (COLOR.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (A.A.)
COMINCO (COLOR.)
COMINCO (A.A.)
STELCO (COLOR.)
CANMET (COLOR.)
BRIT.STEEL.TEESIDE (A.A.)
BRIT.STEEL.ROTHER. (VOL.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (XRF)
O.S.C. (A.A.)
O.S.C. (SPECTR.1)
O.S.C. (SPECTR.2)
ARMCO STEEL (XRF)
ARMCO STEEL (A.A.)

Figure 1(g)

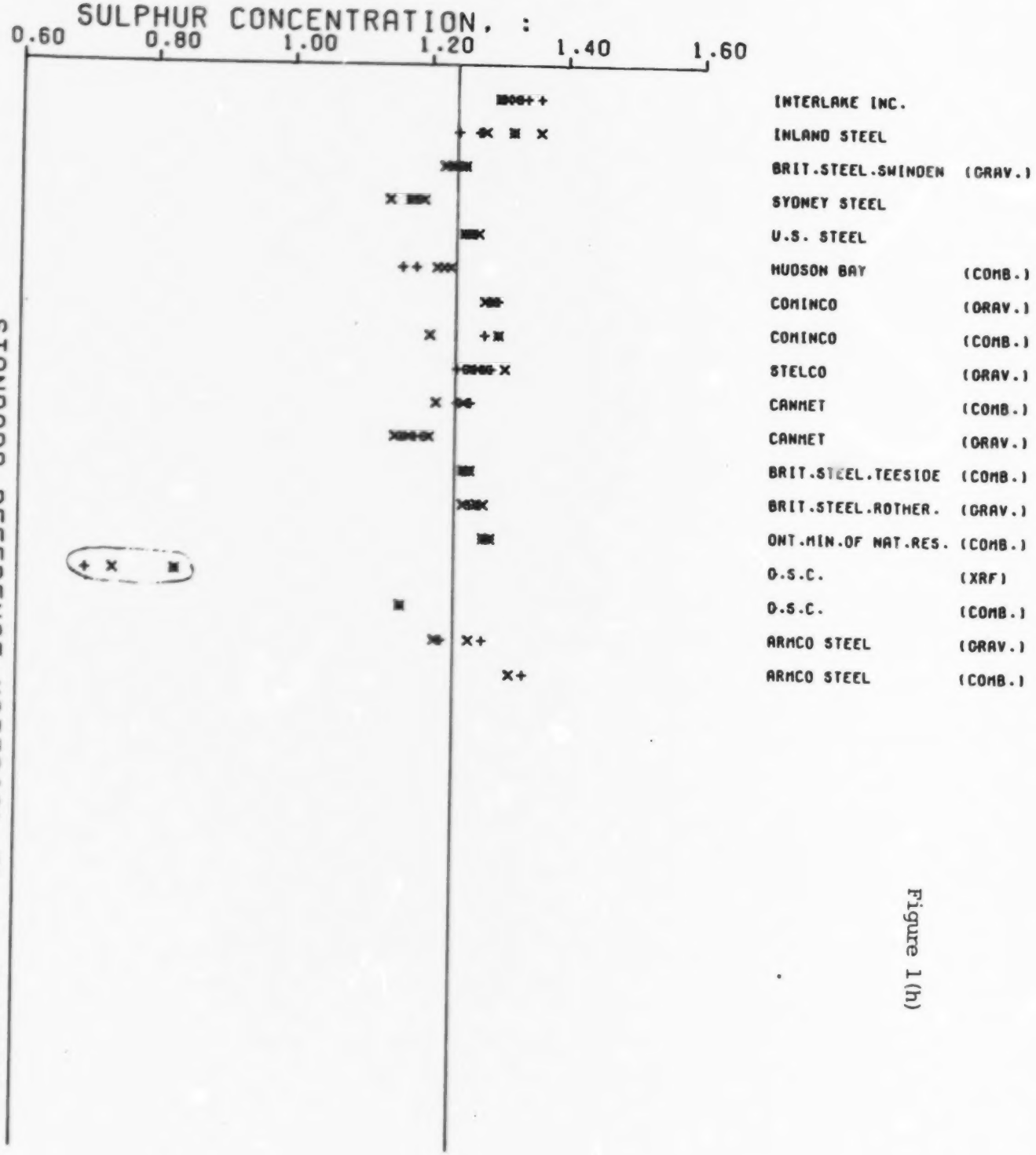
SULPHUR CONCENTRATION, %
0.60
0.80
1.00
1.20
1.40
1.60
STANDARD REFERENCE MATERIAL SL-1, SULPHUR
INTERLAKE INC.
INLAND STEEL
BRIT.STEEL.SWINDEN (GRAV.)
SYDNEY STEEL
U.S. STEEL
HUDSON BAY (COMB.)
COMINCO (GRAV.)
COMINCO (COMB.)
STELCO (GRAV.)
CANMET (COMB.)
CANMET (GRAV.)
BRIT.STEEL.TEESIDE (COMB.)
BRIT.STEEL.ROTHER. (GRAV.)
ONT.MIN.OF NAT.RES. (COMB.)
D.S.C. (XRF)
D.S.C. (COMB.)
ARMCO STEEL (GRAV.)
ARMCO STEEL (COMB.)

Figure 1(h)

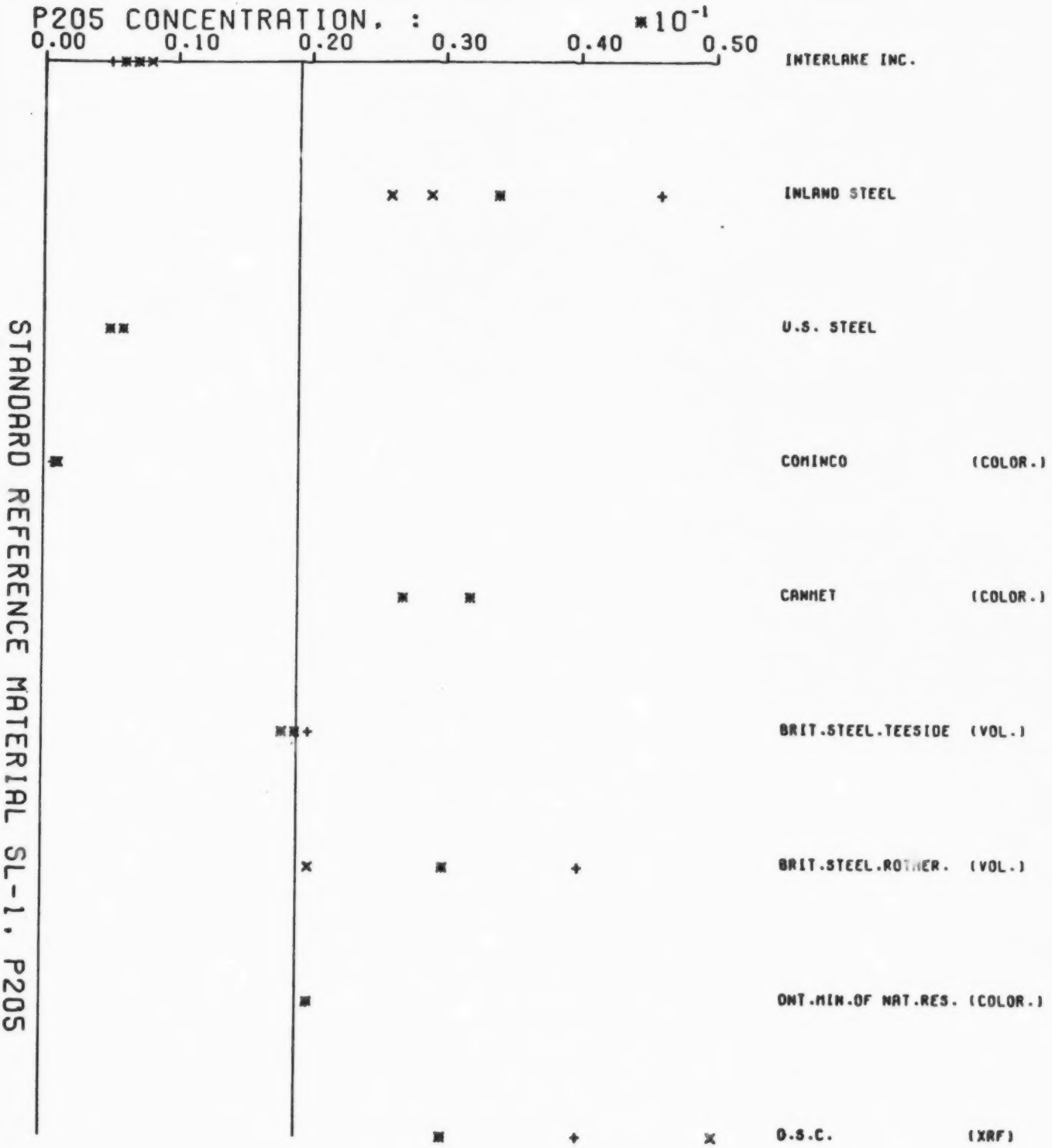
P2O5 CONCENTRATION, : *10⁻¹
0.00
0.10
0.20
0.30
0.40
0.50
INTERLAKE INC.
INLAND STEEL
U.S. STEEL
COMINCO (COLOR.)
CANMET (COLOR.)
BRIT.STEEL.TEESIDE (VOL.)
BRIT.STEEL.ROTHER. (VOL.)
ONT.MIN.OF NAT.RES. (COLOR.)
O.S.C. (XRF)
STANDARD REFERENCE MATERIAL SL-1, P2O5

Figure 1(i)

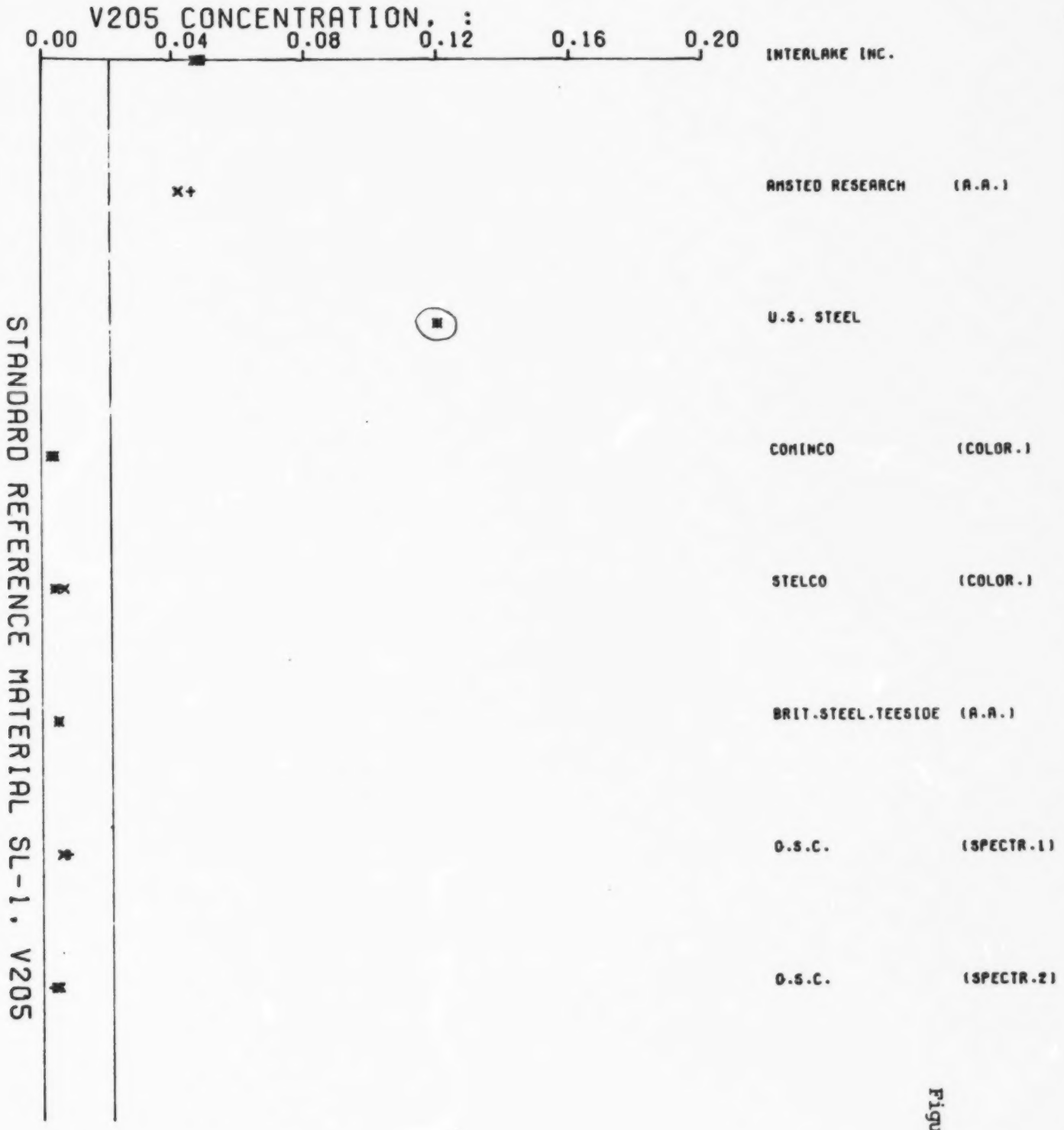
V205 CONCENTRATION, :
0.00
0.04
0.08
0.12
0.16
0.20
STANDARD REFERENCE MATERIAL SL-1, V205
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
U.S. STEEL
COMINCO (COLOR.)
STELCO (COLOR.)
BRIT.STEEL.TEESIDE (A.A.)
O.S.C. (SPECTR.1)
O.S.C. (SPECTR.2)

Figure 1(j)

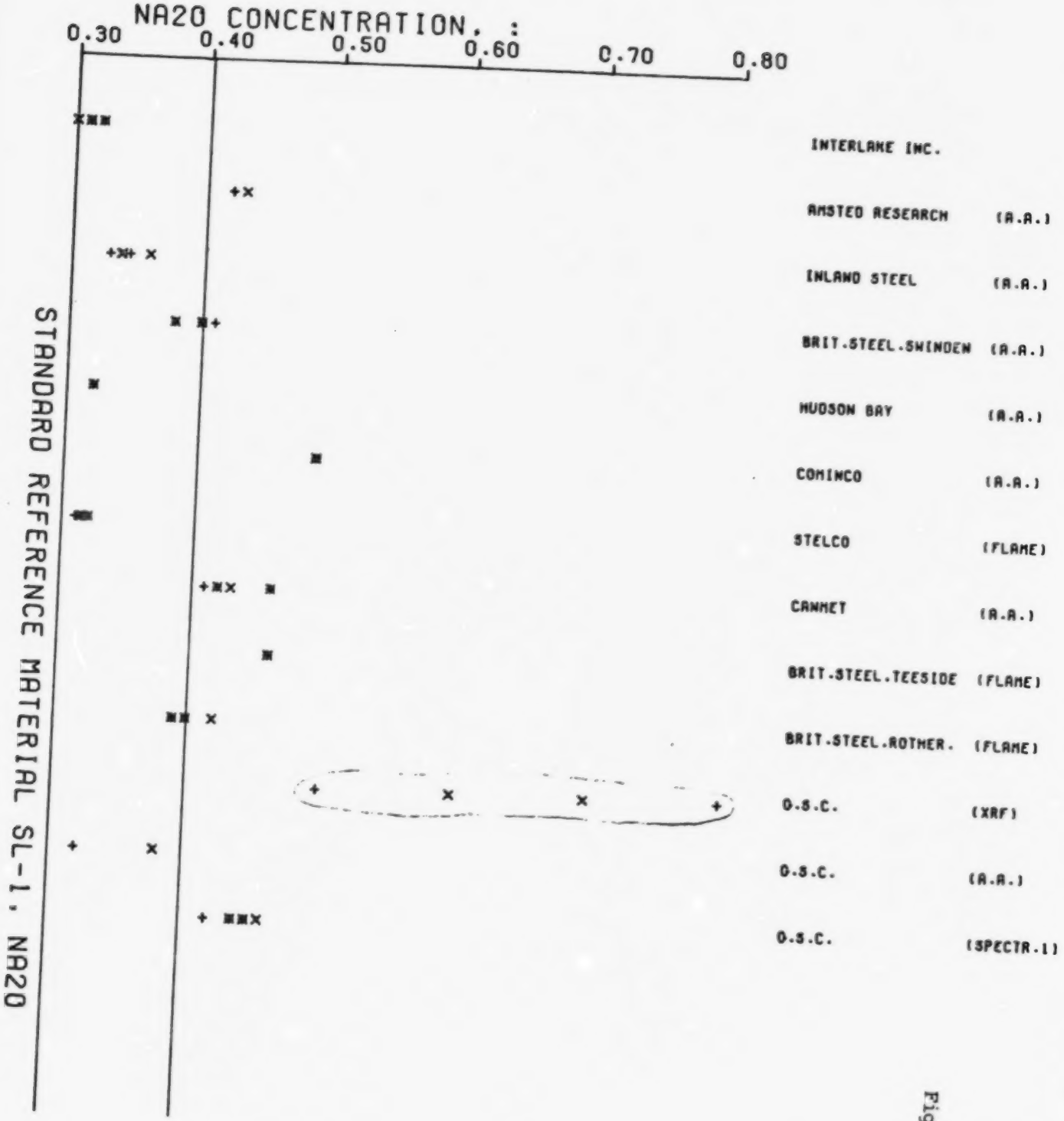
NA20 CONCENTRATION, %
0.30
0.40
0.50
0.60
0.70
0.80
STANDARD REFERENCE MATERIAL SL-1, NA20
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL (A.A.)
BRIT.STEEL.SWINDEN (A.A.)
HUDSON BAY (A.A.)
COMINCO (A.A.)
STELCO (FLAME)
CANMET (A.A.)
BRIT.STEEL.TEESIDE (FLAME)
BRIT.STEEL.ROTHER. (FLAME)
O.S.C. (XRF)
O.S.C. (A.A.)
O.S.C. (SPECTR.I)

Figure 1(k)

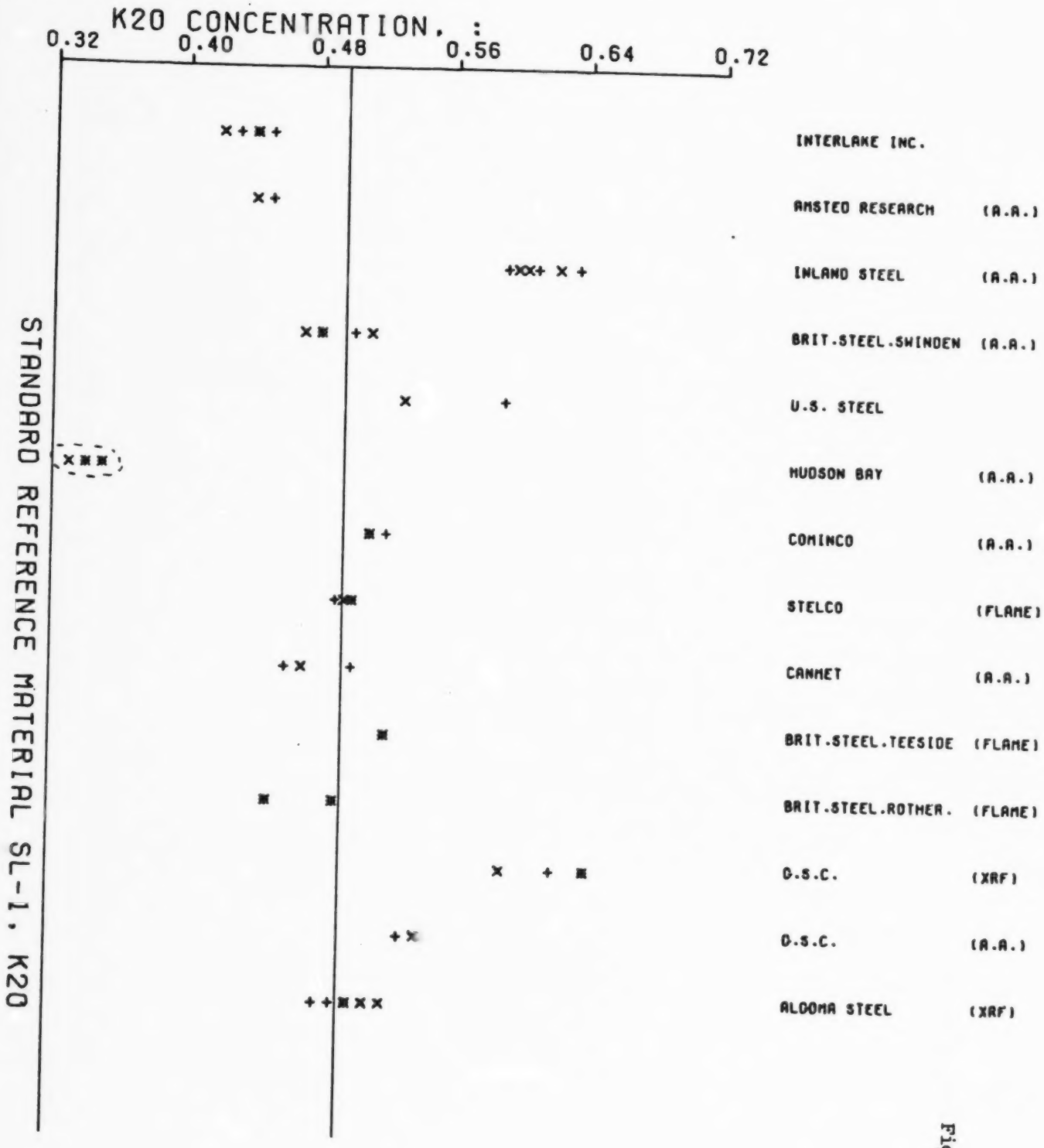
K2O CONCENTRATION, %
0.32
0.40
0.48
0.56
0.64
0.72
STANDARD REFERENCE MATERIAL SL-1, K2O
INTERLAKE INC.
AMSTED RESEARCH (A.A.)
INLAND STEEL (A.A.)
BRIT.STEEL.SWINDEN (A.A.)
U.S. STEEL
HUDSON BAY (A.A.)
COMINCO (A.A.)
STELCO (FLAME)
CANMET (A.A.)
BRIT.STEEL.TEESIDE (FLAME)
BRIT.STEEL.ROTHER. (FLAME)
D.S.C. (XRF)
D.S.C. (A.A.)
ALGOMA STEEL (XRF)

Figure 1(1)

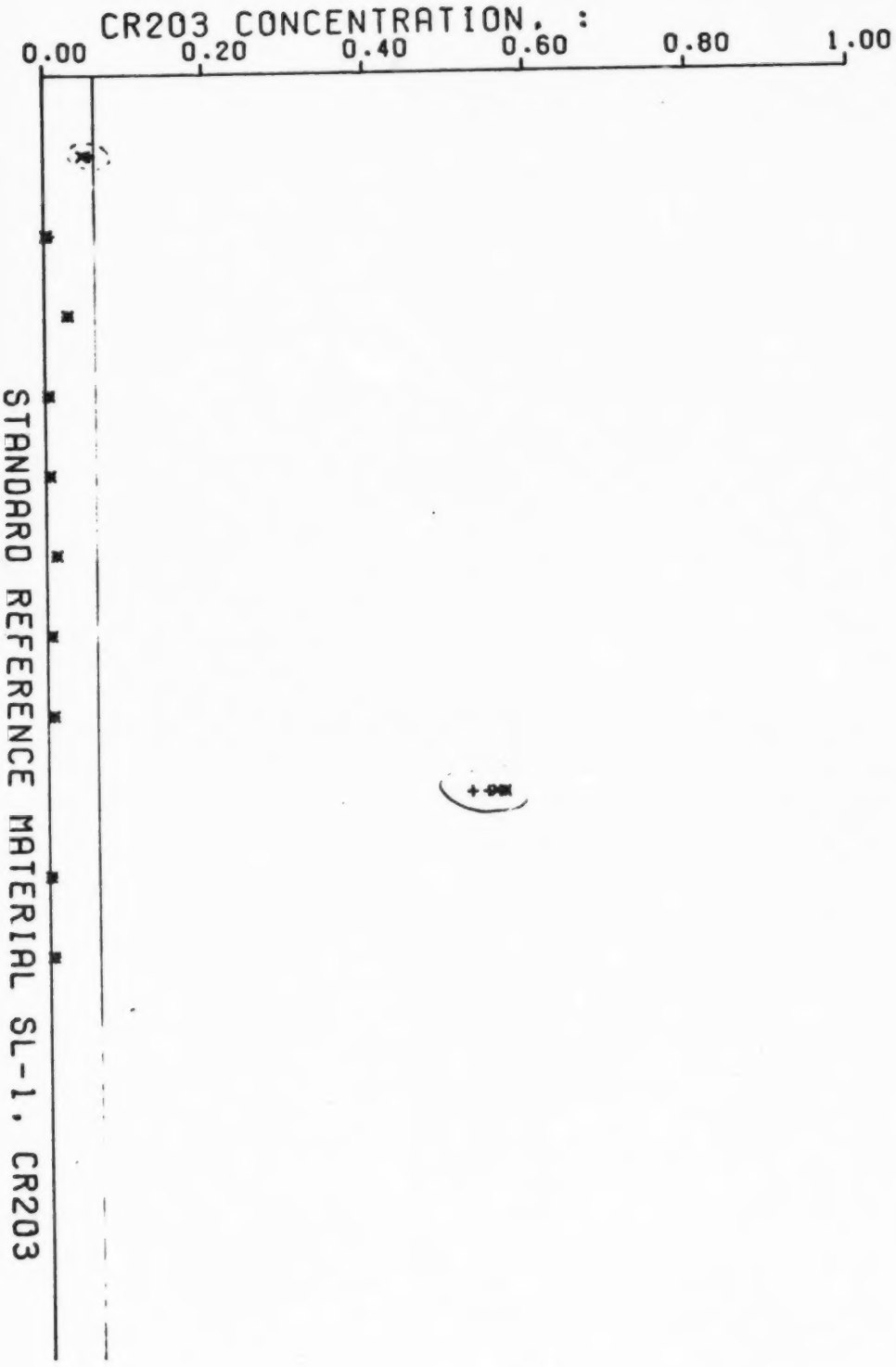
CR203 CONCENTRATION, :
0.00
0.20
0.40
0.60
0.80
1.00
STANDARD REFERENCE MATERIAL SL-1, CR203
AMSTED RESEARCH (A.A.)
INLAND STEEL (A.A.)
HUDSON BAY (A.A.)
COMINCO (COLOR.)
COMINCO (A.A.)
STELCO (COMPL.)
CANMET (A.A.)
BRIT.STEEL.TEESIDE (A.A.)
ONT.MIN.OF NAT.RES. (A.A.)
O.S.C. (SPECTR.1)
O.S.C. (SPECTR.2)

Figure 1(m)

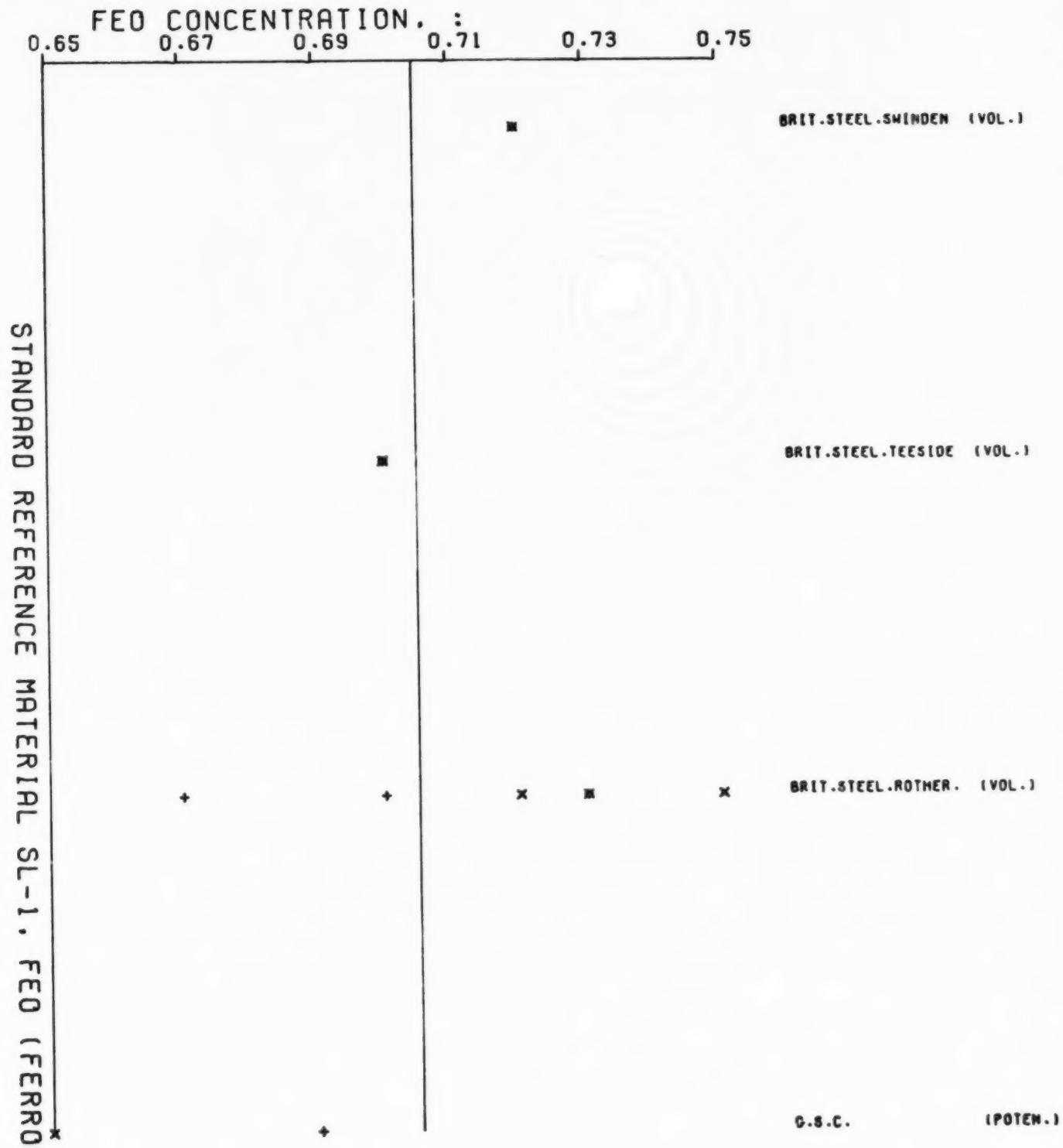
FEO CONCENTRATION. :
0.65
0.67
0.69
0.71
0.73
0.75
BRIT.STEEL.SWINDEN (VOL.)
BRIT.STEEL.TEESIDE (VOL.)
BRIT.STEEL.ROTHER. (VOL.)
C.S.C. (POTEN.)
STANDARD REFERENCE MATERIAL SL-1. FEO (FERROUS ONLY)

Figure 1(n)

POOR

QUALITY

ORIGINAL